SCIENTIFIC AMERICAN

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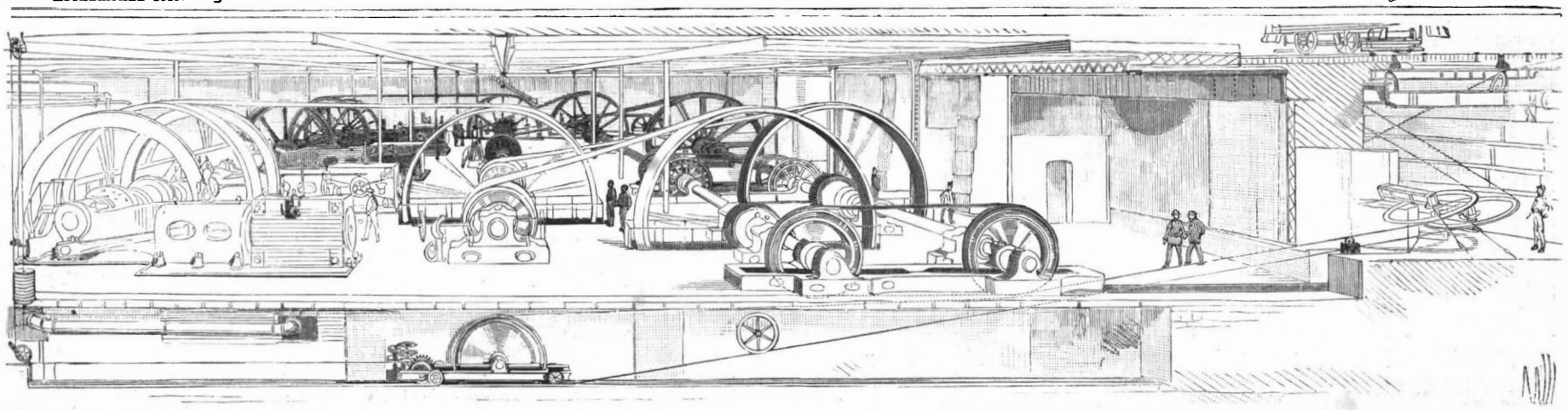

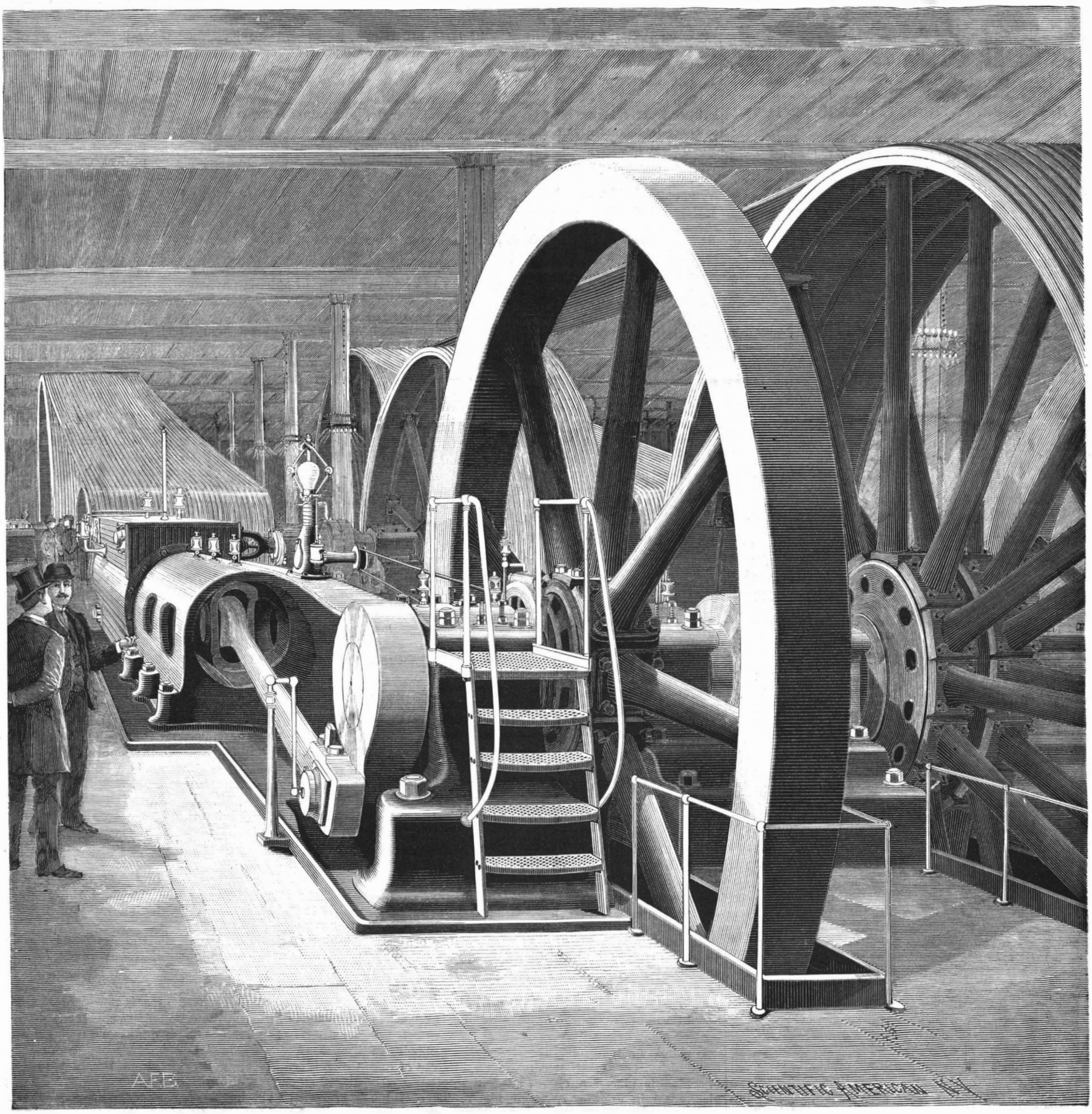

THE BROADWAY CABLE RAILWAY. NEW YORK—THE HOUSTON STREET POWER STATION.—[See page 392.]

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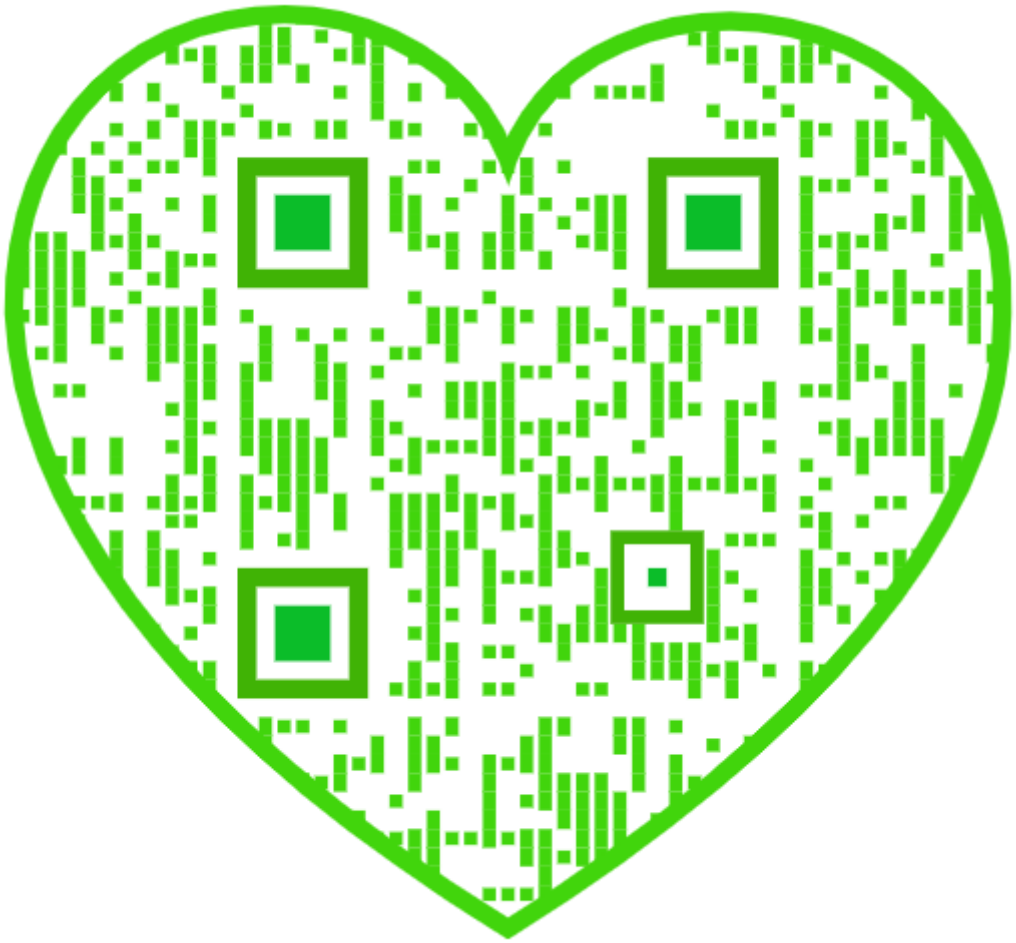

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Contents.

(Illustrated articles are marked with an asterisk.)

Adding machine, Dalton & Myatt's*..... 388
Age, old, recipe to attain..... 390
Agricultural devices, new..... 396
Air, liquid, transporting..... 395
Ants, African..... 389
Boat, torpedo, capsizing..... 387
Books and publications, new..... 396
Brake, engine. Cleveland's*..... 388
Carbonic acid motor, a*..... 395
Children, the ignorance of..... 392
Chocolate tree, cultivation of..... 394
Clock face, 24-hour..... 387
Coal fields, Pennsylvania..... 386
Colors of ancient Egypt..... 395
Diphtheria, the cause of..... 393
Electric storage battery, a new*. 389
Englishmen, increased height of 393
Fertilizer, a new..... 395
Flashlight, aluminum, the..... 394
Foundations, novel*..... 392
Gas supply, Pittsburg natural.... 391
Glass, the porosity of..... 395
Harvad at the top..... 387
Inventions, recently patented... 396
"Justice," a mammoth*..... 390
Lakes and Mississippi, connecting the..... 394
Lamp bulbs, blackening of..... 395
Lemons and oranges..... 390
Lighthouses and keepers..... 387
Lighting streetlamps, a new system of*..... 388
Mammoth, the, in Alaska..... 394
Man, constituents of..... 390
Mortars, U. S., large*..... 393
Noise, the loudest ever heard... 393
Notes and queries..... 397
Oil, vanadiferous..... 394
Oxygen, new use of..... 394
Patents granted, weekly record. 397
Pepper..... 387
Perfumes, automatic distribution of*..... 388
Petroleum, early use of..... 392
Photography, legal uses of..... 390
Photography, screen, in colors... 396
Plastomenite..... 387
Postal service in Africa..... 389
Power station, a great..... 385
Railway appliances, some new... 396
Railway, the Broadway cable*... 385
Scientific expedition lost, a..... 394
Search light, the, in war..... 390
Sewage of a large city, treating.. 391
Smoke prevention..... 394
Silver ware, Chinese..... 391
Ten miles above the earth..... 391
Tension of liquid films*..... 395
Time recorder, Bundy's*..... 389
Tyndall, Prof. John..... 386
Water mains, wooden..... 391

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 937.

For the Week Ending December 16, 1893.

Price 10 cents. For sale by all newsdealers

PAGE

I. AERONAUTICS.—The Solution of the Flight Problem.—By CARL BUTTENSTEDT.—A suggestion for flight by man without the use of a balloon.—3 illustrations..... 14968
II. ARCHÆOLOGY.—"Anen" Mummy Coffins in the British Museum.—Recent gift to the British Museum..... 14974
III. BIOLOGY.—Structure of Yeast Cells..... 14982
IV. CHEMISTRY.—Caffearine.—A new alkaloid from coffee..... 14982
The Chemistry of Bacteria.—By R. WARINGTON.—The production of nitrates by bacteria.—The role of plant life in effecting chemical changes..... 14981
V. CIVIL ENGINEERING.—Artesian Well Boring in Queensland.—Australian wells, and the benefit to the country.—1 illustration... 14969
The Second Track of the St. Gothard Railroad.—The story of this interesting engineering operation.—The construction of a second track on the Alpine road.—5 illustrations..... 14968
VI. ELECTRICITY.—Electrolytic Indicator.—A test paper for determining the signs of electric circuit terminals..... 14982
VII. ENTOMOLOGY.—Parasitic and Predaceous Insects in Applied Entomology.—By C. V. RILEY.—The limitations of applied entomology.—A most interesting and practical contribution to the subject..... 14979
VIII. HORTICULTURE.—A Wireworm Trap.—A simple appliance for catching this obnoxious caterpillar.—1 illustration..... 14974
IX. MECHANICAL ENGINEERING.—A New Steam Turbine.—The De Laval turbine, giving 20,000 revolutions per minute.—1 illustration..... 14970
A Weldless Steel Chain.—By M. SIMON-BRUNSCHWIG.—A weldless chain of greater strength than the old type.—Details of its manufacture.—13 illustrations..... 14969
Oil Fuel for Boilers.—Firing with oil on a large scale, as done in Chicago at the Fair.—2 illustrations..... 14971
X. METALLURGY.—New Method of Casting Steel Ingots.—Application of centrifugal force for casting Bessemer and open hearth steel ingots..... 14969
XI. MICROSCOPY.—Microscopical Notes.—Notes on stains and other practical points..... 14974
XII. MINERALOGY.—Development of Mineralogy.—By L. P. GRATACAP.—The second of this most interesting of papers, treating on Pliny's Book on Gems..... 14977
On the Diamond in the Canon Diablo Meteoric Iron and on the Hardness of Carborundum.—By GEORGE FREDERICK KUNZ and OLIVER W. HUNTINGTON, Ph.D.—An undoubted discovery of diamond in meteoric iron..... 14982
The Annual Exhibition of the Mineralogical Department of the Brooklyn Institute.—Striking exhibits shown on this occasion.... 14976
XIII. NATURAL HISTORY.—The Tallest Mammal.—By R. LYDEKKER.—Interesting article on the great African giraffe.—1 illustration..... 14978
XIV. NAVAL ENGINEERING.—H. M. S. Speedy.—A new first class torpedo gun boat.—Details of her trials.—Her boiler.—1 illustration..... 14967
XV. PHYSICAL GEOGRAPHY.—The Making of Montain Chains.—By H. G. WELLS.—Theories of the formation of mountains.—8 illustrations..... 14974
The New Physical Geography.—By RALPH S. TARR.—A very interesting article, giving the last developments of this science.. 14975
XVI. PHYSICS.—Change of Volume when Liquids of Different Densities are Mixed.—By WILBUR S. SCOVILLE.—Result of a lengthy research into this point..... 14981
Tobacco Smoke Floated upon Carbonic Acid.—A simple experiment in physics without apparatus.—1 illustration..... 14974
XVII. TECHNOLOGY.—Brown Wood Pulp.—Pulp for the manufacture of brown paper..... 14971
Paper Mills in India.—Interesting notes on this industry..... 14971
Sugar Making in Hawaii.—Full details of the manufacture of sugar in the Sandwich Islands..... 14973
The Confectionery and Bakery Exhibition.—Improved machinery recently exhibited in London.—4 illustrations..... 14972
Utilization of Old Rubber.—By R. HENRIQUES.—How old rubber shoes are worked over..... 14973

PROF. JOHN TYNDALL.

On the evening of December 4, Prof. John Tyndall died. The son of an Irish policeman, a man whom he himself described as "socially low, but mentally and morally high," he had before him the task of working his own way up in the world. He was born August 21, 1820, in Leighlin Bridge, near Carlow, Ireland. He left school at the age of nineteen, and joined the Irish Ordnance Survey. Here he may be said to have begun his scientific career. In 1841 an official asked him how he employed his leisure hours, and told him that with five hours a day at his disposal they "should be devoted to systematic study." He added, "Had I when at your age had a friend to advise me as I now advise you, instead of being in a subordinate position, I might have been at the head of the survey." Next morning it is said Tyndall was at his books at five o'clock, and for twelve years followed the advice given him.

He became dissatisfied with his slow progress, and in 1844 wished to emigrate to America. But a position as railroad engineer in England was obtained for him, and he remained. In 1847 he took the position of master of Queenwood College, Hants, Hampshire. He showed great talent for teaching and began to contribute scientific papers to scientific periodicals. In May, 1847, his father died. In 1848, with Frankland, since professor of chemistry in the Royal Institution, he went to Germany. There, under Bunsen, Knoblauch and Magnus, he studied science for two years, receiving his degree in 1850. In 1851, on his return to London, he met Faraday. He was at once taken up by the great master, and was associated with Faraday in his work at the Royal Institution of Great Britain. He was appointed to the chair of Natural Philosophy there in 1853, and after Faraday's death in 1867 succeeded him as superintendent.

He published many works and papers on scientific subjects. His books, written for the popular taste, are excellent examples of scientific exposition. In 1872, when at the height of his fame, he made a lecturing tour of the United States. His lectures, given in this city, were received by large audiences, no experimental lectures, probably, ever being greeted with such *eclat*. The daily papers reported them with illustrations of the experiments in some cases—testifying to the interest in them on the part of the public. His receipts from the lectures—some $13,000—he presented to Harvard University, Columbia College, and the University of Pennsylvania, founding scholarships in aid of students who devote themselves to original research.

A great Alpine climber, for many years he visited Switzerland, and there met his wife, also an enthusiast on mountain climbing, whom he married when he was 56 years old. She was the innocent cause of his death. He had been ill for some time, and was taking both chloral and sulphate of magnesia. By mistake his wife gave him a large dose of chloral, thinking it was the magnesia. As she realized what she had done, she told him. He cried, "You have killed your John." He jumped out of bed and called for a stomach pump. The physician was summoned, who gave an emetic which operated, but life could not be saved, although the doctors worked over him all day. The fatal dose was taken at 8:30 A. M., and death occurred ten hours later, 6:30 P. M.

SCREEN PHOTOGRAPHY IN COLORS.

As has been known for some time, the primary colors of the spectrum, red, blue, and green, when combined, produce white light. The utilization of these colors in reproducing photographs in the colors of nature has been proposed and demonstrated by Mr. Fred. Ives, of Philadelphia. His method has been lately improved upon by an optician of this city, Mr. R. D. Gray, and it was our privilege to witness his public demonstration of his improvements on the 8th instant.

He follows out the usual method of taking pictures for color reproduction, by first taking in the camera on an orthochromatic plate, with a red screen between the lens, a picture in which all the light values of the blue and white rays are excluded, allowing only the color values of the reds in the subject photographed to be reproduced. In making such a photograph, which takes the longest time, he usually has the lens stopped down to $f/8$ and gives an exposure of three minutes. He then takes another negative with the camera in the same position, in which nothing but the green of the object photographed has any effect on the plate. Still retaining the camera in the original position, the third negative is taken in the ordinary way with white light, or without any tinted screen behind the lens which represents all the value of the blue and white rays that emanate from the object. After these negatives are once made, it is simply a matter of ordinary photography to reproduce from them lantern slides or positives.

It should be mentioned that the lantern consists of three objectives and three condensers, in front of one of which is placed a blue glass, in another a red glass, and in another a green glass. These three optical systems are illuminated by three separate jets of lime light, or instead of lime light the electric arc light may be used.

To project the three separate positive pictures in a lantern, he has a square light wood frame divided into four compartments or four apertures, and he uses three of these apertures for holding the plates, and his method of aligning the respective plates with the lantern is somewhat ingenious and practical.

One of the most difficult problems connected with this system of projecting the color pictures upon the screen is to make them exactly coincide, and Mr. Ives had great trouble in doing this when he made a public exhibition, but Mr. Gray has perfected a very simple and ingenious device for bringing each picture into the proper alignment. He first takes one plate and secures that in one division of the lantern slide frame, and places it in the lantern; he then takes the second plate and places that in the second division of the frame, and then applies his adjusting attachment. One person stands at the lantern and one at the screen. The operator at the lantern then operates the adjusting screw until the position of the plate is such that the person at the screen decides that the two images coincide. The third plate is similarly adjusted in the lantern slide frame by a duplicate adjusting device. The whole is then removed from the lantern and each plate is sealed in position, so that, for that particular lantern, this lantern slide frame is all ready for use and will always register accurately upon the screen. The positions of the pictures in the lantern frame correspond to the colored screens through which they were originally made.

As a result of this method it is a very simple matter to place picture after picture in the lantern and run them through the same as an ordinary lantern, and Mr. Gray claims that while others have only shown a few slides made for color projection, he has been able to produce a larger number.

Having thus perfected the minute detail of adjusting the pictures and the apparatus for showing them, it was very easy and simple to project them on the screen, and the marvelous beauty and delicacy of the combined colors in showing the various grades of color in the pictures was surprising and most pleasing, and gave one a more adequate idea of the beauty of the landscape than an ordinary monotone photograph. In pictures of autumn foliage the delicate reds and yellows would appear to great advantage, in photographs of distant mountains the azure blue of the sky covered with scattered white clouds appeared with most natural effect, contrasting finely with the snow-capped peak and the brown and green foliage below, and in portraiture the color of the skin, the clothes and accessories were most admirably reproduced. The red and green in a watermelon picture were capital.

In using the lime light, when colors are combined, before the insertion of the slides, the appearance of the screen is white, with a slight tinge of blue. It is supposed that if the electric arc light is used in place of the lime light a still better result may be obtained.

The success of Mr. Gray in demonstrating the practicability of projecting photographs in colors is certainly an advance in this line of work. We believe he has applied the same principle to the reproducing of colored photographs in printing inks.

THE PENNSYLVANIA ANTHRACITE COAL FIELDS.

The late report of the commission appointed by the State of Pennsylvania to investigate the subject of "Waste in Coal Mining" contains matter of general interest.

The anthracite coal fields are found within an area of some 3,300 square miles, about 484 of which contain workable coal beds. This area would form a polygon by drawing a line from the northeastern limit in Wayne County westward to Bernice, then southwest to Dauphin, then northeasterly to Mauch Chunk, then to point of beginning, mostly in the counties of Wayne, Wyoming, Luzerne, Schuylkill, Carbon, Dauphin, Northumberland, and Huntingdon.

Prof. J. P. Lesley, in charge of the Geological State Survey, is of the opinion that originally the coal field covered the whole State and parts of the neighboring States, a remnant of which is found in the anthracite bed in Rhode Island.

The anthracite exists wholly in the area east of the Allegheny Mountains, and on the west of that range nearly the whole area rests on an almost unbroken field of bituminous coal.

The anthracite condition was, no doubt, produced from the original bituminous by the great convulsion uplifting and folding the rock strata which took place at the close of the carboniferous period.

The disturbed or uplifted area is well defined, but how much of the coal was changed to anthracite we do not know; probably not all, as would seem to be shown by the Broad Top coal field in Huntingdon County, which is semi-bituminous, though in the midst of the disturbed or present anthracite region.

The coal field has been, for convenience, divided geographically into the Northern, the Eastern Middle,

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the Western Middle, and the Southern. The Southern field, which includes the Lykens Valley, is estimated to contain about one-half of all the anthracite remaining.

The evidence as accepted by the geologists shows that the original coal bed east of the Allegheny Mountains was not less in area than 17,000 square miles, whereas the present field, as stated above, has an area of only 480 square miles.

The disappearance or destruction of the coal bed, as indicated by the above figures, was unquestionably caused by *erosion*, *i. e.*, the action of water currents and ice, chiefly in the form of icebergs. Estimating the average amount of coal at 96,000,000 tons per square mile, the contents of the original field was 1,632,000,000,000 tons, of which the now existing field contains only a little more than one per cent.

In the large area in the southeastern part of the State, comprising eleven counties, erosion has carried away every trace of the original coal bed and many thousand feet of the underlying rock.

On the basis that the original bed was confined to the 3,300 square miles within which the present field is located, the loss by erosion was not less than 94 per cent.

From the knowledge derived from the mines already worked, it is roughly estimated that the original bed of coal averaged 75 feet in thickness. In many of the basins only the lowest beds have been preserved.

The amount of coal mined since mining was commenced in 1820 is about 2,225,000,000 tons and the amount remaining in the ground is 17,245,000,000 tons.

The work of mining, including the treatment of the coal in the breakers after it is brought from the mines, is attended with an incredibly great loss, it having been the practice from the commencement of mining to deposit in banks the so-called "waste," or unmarketable material, much of which consists of fine coal and coal dust, called "culm." The amount of this "waste" accumulated since 1820 can be partially measured when, *e. g.*, in the Lawrence colliery it has been equal to 53 per cent of the shipments, in the Stanton colliery 74 per cent; in the Parrish colliery, which may be taken as an example of a modern colliery, and where all the small sizes are saved, about 19 per cent goes to the dirt bank. On a thorough examination of the dirt banks in the Panther Creek basin, it is estimated that, from 1820 to 1883, 20 per cent more coal lies in the dirt bank than has been marketed.

A general estimate has been made, based on very extended examinations, that since the mining was begun the amount of coal and coal dirt sent to the culm heaps has been 35 per cent of the total production.

In addition to the constant loss or reduction of product by the presence of "waste," the work of mining is attended with an increasing expense as the depth of the excavations increases, in some mines being more than a thousand feet, and the Lykens Valley bed lies at a depth of more that 4,000 feet.

In some collieries from 15 to 20 per cent of the coal is used under the engine boilers.

How to recover the immense amount of coal in the waste banks and render it marketable is a question of great moment and has long been under consideration.

Some of the old waste banks have already been partially worked over, and from 50 to 75 per cent of good coal obtained. Most of this coal is very fine and more or less powdered, and its utilization of course depends on successful means for burning it, and thereby creating a market demand. Within a few years various schemes and new constructions of furnaces have been tried, with most encouraging success. Pea coal is already sold in rapidly increasing quantities, also buckwheat coal, size No. 1, and buckwheat No. 2 is somewhat in demand, it being mixed with bituminous. Attempts are making to burn the dust or culm by blowing it into the furnace, but expense would be increased if it were necessary to reduce it to an impalpable powder.

It is also claimed that eventually the "waste" will be largely used in the form of artificial fuel, being mixed with suitable binding material and compressed into blocks. Several plants for the manufacture are in successful operation, and the article is known in the market as "eggettes."

In addition to the loss arising from the accumulation of the discarded "waste," the loss arising from the necessity of leaving large pillars of coal as supports is great, and it is estimated that the amount of coal won from the whole field since mining commenced does not exceed 35, and possibly not more than 30, per cent of the original deposit in the sections mined.

THE Novelty Cutlery Company, of Canton, Ohio, have conceived a novel idea in the manufacture of pocket cutlery, razors, paper knives, ink erasers, etc. Underneath a transparent and almost indestructible handle is a photograph representing machinery or any other class of goods with the portrait, if desired, and address of the manufacturer, rendering the article an appropriate souvenir to present their friends and customers.

Lighthouses and their Keepers.

The following is from a paper by Edward P. Adams, read before the Boston Society of Civil Engineers.

Much of the following is condensed from Johnson's "The Modern Lighthouse Service," a publication of the United States Lighthouse Board.

The famous Pharos of Alexandria, built about 285 B. C., is the first light of undoubted record.

The lighthouse at Corunna, Spain, built in the reign of Trajan, and reconstructed in 1634, is believed to be the oldest existing lighthouse. England and France have towers which were erected and used as lighthouses by the Roman conquerors.

The famous Cordovan tower of France, at the mouth of the Gironde, in the Bay of Biscay, was completed in 1611, in the reign of Henry IV., and after a lapse of 280 years it is still considered the finest lighthouse in the world, though it has been increased in height.

The erection of Eddystone lighthouse of Plymouth, England, completed in 1759, made a new era in the construction of lighthouses. The fifty courses of granite were so dovetailed and fastened together that the tower was almost as rigid as if cut out of solid rock.

The great distinction between the later towers and their predecessors is that the stones of each course are dovetailed together laterally and vertically, so that the use of metal or wooden pins is needless. This method was first used at Hanois Rock, Guernsey.

The first lighthouse in America was built at the entrance to Boston Harbor in 1715-16, at a cost of about $11,500. Erected by the order of the general court of the Province of Massachusetts Bay, it was supported by light dues of one penny per ton on all vessels except coasters.

The first light-keeper in this country whose appointment is on record was George Worthylake, who was appointed keeper of the lighthouse at Little Brewster, Boston Harbor, in 1716, at L. 50 per year by order of the general court of the Province of Massachusetts Bay. When the Federal government had assumed charge of the Lighthouse Establishment, the appointment of keepers was made by the President, and quite a number of commissions bear the signature of George Washington or Thomas Jefferson, who took great interest in lighthouse affairs.

As the number of light-keepers increased, their nomination was made by collectors of customs, who were the local superintendents of lights, but the appointment was made by the Secretary of the Treasury. This usage still holds; but the nomination of the collector is forwarded to the Lighthouse Board, whose indorsement procures for it favorable or adverse action. The appointment, however, is temporary. It continues only until the candidate has been examined; after which, if he passes, a full appointment is given him. Otherwise, he is dropped from the service.

The appointment of lighthouse keepers is restricted to persons between the ages of eighteen and fifty, who can read, write, and keep accounts; are able to do the required manual labor, to pull and sail a boat, and have enough mechanical ability to make the necessary minor repairs about the premises, and keep them painted, whitewashed, and in order. After three months of service, the appointee is examined by an inspector, who, if he finds that he has the qualities needed at that especial station, certifies that fact to the Lighthouse Board, when, upon its approval, the full appointment is issued by the Treasury Department.

But one grade of keeper is recognized by law, but practically they are divided into a number of grades, with pay ranging, with few exceptions, from $350 to $820. The lowest salary is $100 and the highest is $1,000.

At first and second order shore lights there are two light-keepers. A second assistant is required where there is a steam fog signal in connection with the light. At isolated stations another assistant is added. At a few of the most exposed stations there are three and even four assistant keepers.

Keepers are usually appointed to the lowest grade and promoted or transferred according to merit as vacancies occur. At stations requiring but one keeper, retired sea captains who have families are frequently selected. At fog signal stations it is the intention to have one keeper or assistant who is able to operate machinery and keep it in repair.

Keepers are forbidden to engage in any business which will take them away from their stations or interfere with the proper and timely performance of their duties as light-keepers. But such work as curing fish, shoemaking, and tailoring is allowed, and the light-keeper is sometimes a justice of the peace. They are not allowed to keep boarders. At stations where there is sufficient land they have a convenient dwelling with fuel house and often a barn. Suitable boats are furnished stations not accessible by land. A kitchen stove is supplied, also a little coal and sufficient kerosene for lights, and good libraries of about thirty volumes are furnished, and exchanged from two to four times a year.

The amount appropriated for the salaries of keepers is at the rate of $600 per year, amounting to about $700,000 for all keepers in the service.

Plastomenite.

This is the name given to a new kind of smokeless powder invented by Herr W. Guttler. The solution is poured into forms, where it becomes a fairly hard substance, capable of being pressed, rolled, etc. The substance can be colored at will, and is, like celluloid, serviceable for numerous purposes. Plastomenite is used for blasting powder, powder for cannons and rifles, signal rockets, etc. The greatest advantage claimed for it is complete durability, while all other smokeless powders manufactured by the means of ether and nitro-glycerine invariably deteriorate. The combustion of plastomenite is also, it is claimed, so well balanced that it leaves no residue in barrel or cartridge, although the striking velocity of the projectile is unusually great. The initial velocity from a 6½ mm. caliber is 715 m., with a gas pressure of considerably below 3,000 atmospheres. It is said that neither cold nor hot weather has any effect upon the plastomenite cartridges, whereas all powders containing nitro-glycerine suffer from changes in the temperature. Hitherto plastomenite has principally been manufactured for sporting purposes, but its good qualities have attracted the attention of the German military authorities, and it will now be extensively tested in the army.—*Engineering.*

The 24 Hour Clock Face.

On the first of December Italy adopted the time of Central Europe. All the Italian time tables have, by order of the Minister of Public Works, been printed with the hours marked up to twenty-four, from midnight to midnight. The railway clocks have also been modified, and the hours from 13 to 24 printed in red Arabic characters in a circle interior to the old one.

At the Paris Exhibition, in 1867, Sig. G. Jervis, the Keeper of the Royal Industrial Museum of Turin, exhibited a clock face having a double series of hours, the higher numbers being placed on the exterior circle on account of the greater space there available. He also exhibited a time table drawn up on the 24 hour plan, and possessing many advantages over those in use even at the present time. After twenty-six years Mr. Jervis has the satisfaction of seeing the adoption of the improved clock dial and the 24 hour time table proposed by him.

The American Society of Civil Engineers adopted the 24 hour clock face some time ago.

The Capsizing of a Torpedo Boat.

A Gibraltar correspondent of the *Daily Graphic*, describing the recent accident to the Rodney's torpedo boat, says: "She had just fired a torpedo, when, for some reason which has yet to be explained, she suddenly capsized. Most of the occupants succeeded in getting clear at once, but one stoker, not so fortunate, remained entangled, and eventually went down with the boat, which sank in about ten minutes. On turning over, the screws of the boat continued to revolve with spasmodic efforts, and steam issued from the sides in large volumes. One of the crew could be seen running about on the bottom of the boat, and onlookers expected every moment to see an explosion of the boilers. The boat ultimately went down head foremost, like the Victoria, without an explosion. It was, in fact, a miniature Victoria accident, without the collision. Boats from the Immortalite, Narcissus and Rodney were soon on the scene, and every one was picked up except the stoker."

Pepper.

The pepper constituent, to which the sharp taste is due, is the piperine. This substance is not tasteless, as generally accepted, but by prolonged contact with the tongue develops the sharp taste which can be better demonstrated by tasting a piperine solution warmed to 50° C.; in the pepper fruit the piperine is dissolved in the essential oil, hence the decreased sharpness of old pepper is explainable by the resinification of the essential oil, causing decreased solubility of the piperine. The essential oil has the odor of the fruit, but in alcoholic solution is free from any sharp taste. As an oxidation product of the essential oil, in part at least, is a viscid unsaponifiable oil which also dissolves piperine, but itself is free from odor and taste. In addition to these three constituents, pepper contains cellulose, starch, and small quantities of coloring matter.—*Th. Weigle, Pharm. Ztg.*

Harvard at the Top.

The highest meteorological station in the world is said to be that at Charchani, near Arequipa, which is 16,650 feet above sea level, and is situated just below the permanent snow line. The Harvard College Observatory at Arequipa is 8,050 feet above the sea, and the new meteorological station is 8,600 feet above, the ascent being made, by the aid of a mule, in about eight hours. The station is equipped with self-recording aneroids and thermometers. The results of the observations are to be published in the annals of the Harvard College Observatory.

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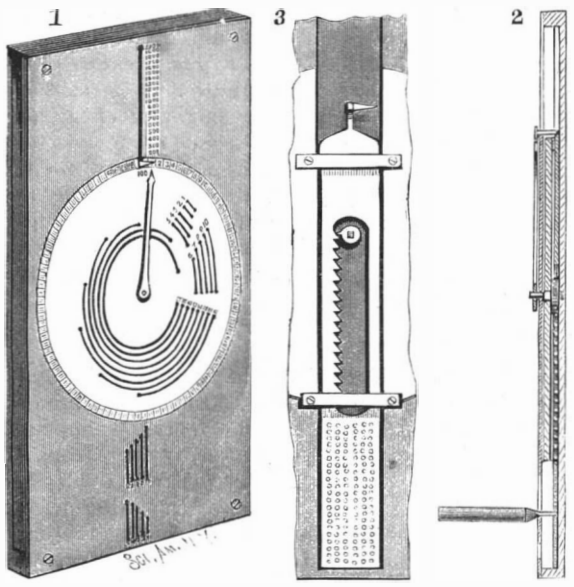
AN IMPROVED ADDING MACHINE.

This machine, patented by Mr. Levi C. Dalton and George C. Myatt, is designed to enable one to perform the arithmetical operation of adding in a very simple and accurate manner by mechanical means. Fig. 1 is a face view and Fig. 2 a central section of the improvement. The casing is covered by a fixed dial plate, on which, in a circle, are the consecutive numbers from 1 to 100, and the pointer is secured to a central shaft on which is fixed, directly below the dial plate, a wheel or disk whose top surface is occupied by circular rows of recesses or apertures adapted to be engaged by the pointed end of a pencil-like tool. The latter is adapted to be passed through segmental numbered slots of different lengths in the dial plate, and, when placed in one of these slots at its numbered

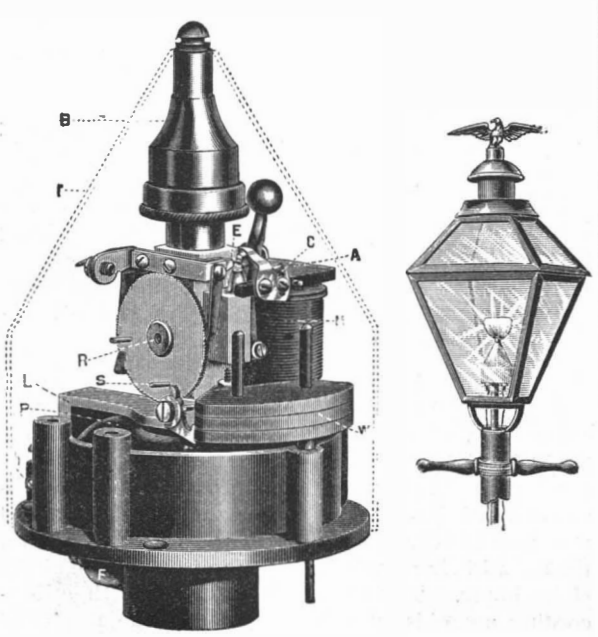


DALTON & MYATT'S ADDING MACHINE.

end, it engages a recess in the wheel or disk below; upon then being moved along the slot, the disk below the dial plate is rotated, and when the tool strikes the end of the slot, the pointer on the dial face has moved to a position indicating on the circle of numbers the amount represented by the length of the slot—the disk, shaft and pointer moving together. When the tool is thus placed and moved in slot 10, say, such number is indicated by the pointer on the dial, the pointer being further moved to 100 by placing the tool in and moving it to the end of slot 90. On the central shaft, below the disk, is a collar having a tooth adapted to engage one of the teeth of a rack in a slide moving in a recess in the casing, as shown in Fig. 3, there being on the upper end of the slide a pointer extending through a straight slot in the dial plate. The latter pointer indicates on a "hundreds" column, in which the numbers range from 100 to 2,000, the pointer being moved up one space for each complete revolution of the shaft. In the lower end of the slide are rows of apertures or recesses, similar to those in the disk, and in front thereof, in the lower portion of the dial plate, are numbered vertical slots of different lengths. By moving the slide with the tool passed through one of these slots, the pointer is correspondingly advanced on the hundreds column. Further information relative to this improvement may be obtained of Mr. James K. Langford, Doniphan, Mo.

A NEW SYSTEM OF LIGHTING STREET GAS LAMPS WITHOUT THE USE OF WIRES.

An electrical system of gas lighting for city streets which operates devices located miles from a central station, without any electrical connection between them, sounds like a fairy tale, but such a system has been introduced by the Cutler-Hammer Manufacturing Company, 247 South Jefferson Street, Chicago, Ill. This system discards the unsightly overhead wires and the expensive underground circuit, and adopts a new and inexpensive method. Each lamp is supplied with two sal ammoniac batteries and a spark coil placed in an iron box buried in the ground at the foot of the post. In the lantern is a miniature gas holder of about two cubic inches capacity, pivoted on a hinge and held down by weights; and directly over this holder is an automatic gas lighter, similar to those used in houses. Two wires about ten feet long connect the lighter with the batteries through the post. Such an installation is under complete control from the gas works. When it is desired to light the lamps of a city, it is only necessary to open the valve connecting one of the large gas holders at the works direct with the gas mains. This results in a decided increase of pressure in the gas all over the city, sufficient to cause all the little gas holders in the lamp posts to lift up about one-eighth of an inch against a platinum stop, and thus close the local battery circuit at each post. The automatic lighter being then supplied with current, immediately turns on and lights the gas.



A NEW SYSTEM OF LIGHTING STREET GAS LAMPS WITHOUT THE USE OF WIRES.

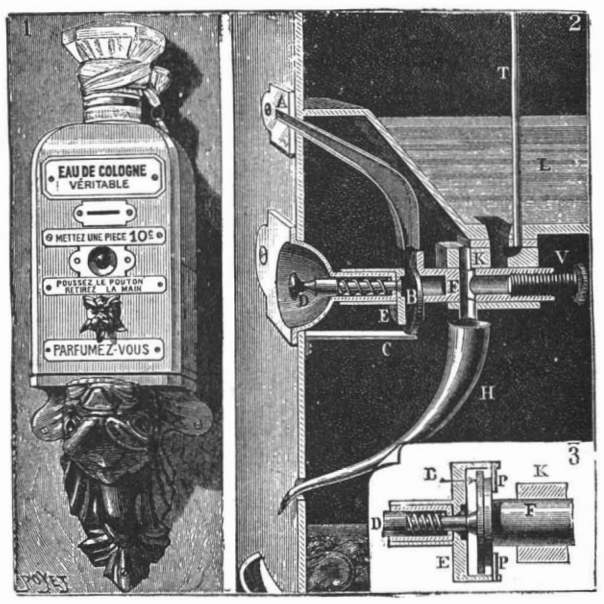
Our engraving shows the lighter about two-thirds full size. P is the pressure gauge or gas holder sealed with mercury and held down by the weights, W. When the gauge lifts, it closes the electric circuit through the magnet, M; the armature, A, is attracted and caused to vibrate, throwing sparks at E and turning the ratchet wheel, R. The first movement of the ratchet wheel admits the gas to a small auxiliary outlet at E, as well as to the main burner. The electric sparks formed at E ignite the auxiliary jet, which immediately shoots up and lights the main burner. As the ratchet wheel continues to turn, the auxiliary jet is closed, leaving the main burner open. The ratchet wheel is finally stopped, with the gas turned full on and lighted, by a pin in the wheel striking against a stop, S, attached to the pressure gauge, P.

It has been shown in practice that fifteen seconds is amply sufficient for maintaining this increased pressure, to give time to make the increase felt everywhere. It can then be brought back to normal pressure, when the pressure gauge, P, will drop back and open the electric circuit. This operation, if repeated, will extinguish the lamps.

A heavy cast iron shell, 3-16 of an inch thick, shown by dotted lines in the cut, entirely surrounds the mechanism and thoroughly protects it from all kinds of external abuse. The iron battery boxes are supplied with covers flush with the ground, which are intended to be removed once a year for cleaning the batteries, this operation constituting the entire operating expenses.

AUTOMATIC DISTRIBUTOR OF PERFUMES.

For a few weeks past there have been remarked at the doors of stores and in theaters, concert halls, etc., small metal bottles of various colors provided with an enameled plate. These are new automatic distributors, which are distinguished as much by their pleasing form and the simplicity of their mechanism as by their practical utility as retail vendors of expensive perfumes. Fig. 1 gives a general view of the apparatus and represents a bottle 18 centimeters in width by 40 in height, supported against the wall by an ornamented bracket. If a 10 centime piece be put into a slot situated toward the top of the bottle, and we press a button arranged to this effect, we shall immediately see a few drops of liquid fall at the bottom. This result is obtained in the following way, as may be understood by an inspection of Figs. 2 and 3. The coin put in at A falls into a channel that leads it to B, where it rests upon the piece, C. If the button, D, then be pressed, the extremity of its rod, meeting the coin, drives before it the cylinder, F, which slides in a jacket, K. The cavity situated near F is displaced and brings about through this slight motion a suction of air from the exterior. This immediately enters the space left free above, and escapes to the exterior through the tube, T, which is in communication with the atmosphere. But at the same time a few drops of liquid from the reservoir, L, have fallen into the cavity thus disengaged. Upon removing the hand, the pieces, P, whose position is calculated to this effect, travel a sufficient distance before engaging with the flanges of the cylinder, and the coin abandoned in the vacant space falls to the bottom of the bottle. These pieces, P, pulled back by the spring of the button, D, carry the cylinder, F, with them to its original position. The cavity filled with liquid is then in communication with the aperture opposite the discharge tube and flows to the exterior. This arrangement is both very simple and very ingenious. The apparatus can be regulated for any kind of money, and even for operating gratuitously. It suffices, in fact, to close the cavity between B and F in order that the rod of the button, no longer being capable of penetrating this cavity, as in the paying apparatus, may push the piston before it with the least pressure. The quantity of the liquid to be distributed can thus be increased or diminished by means of the screw, V. The absence of complicated and delicate mechanism permits of this distributor being placed anywhere, without any special precautions being taken, say upon cars, boats, carriages, etc. It will be possible, likewise, to replace the continuous perfumery fountains by an apparatus that will furnish liquids only upon the push of a button at the will of the customer. Mr. P. Leoni, the inventor, has another application in view that we must call attention to. It is well known how earnestly our great physicians are at present recommending, under all circumstances, the use of antiseptics and disinfectants. It is, despite everything, difficult to have their prescriptions put up. The automatic distributor, widely disseminated, would permit of diffusing the use of antiseptics either

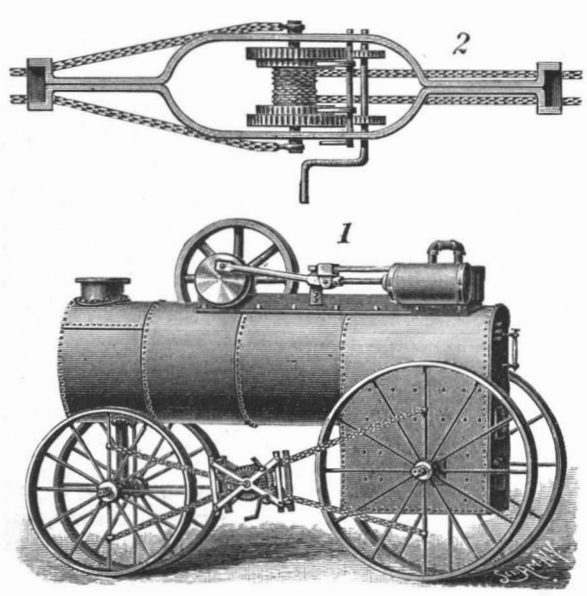


AUTOMATIC DISTRIBUTOR OF PERFUMES.

gratuitously or in exchange for a small coin. The question is now submitted to the study of the sixth commission at the municipal council of Paris. This apparatus, in fact, exciting the curiosity of the public, would certainly obtain great success. It is permitted us, moreover, to judge of it by the apparatus already installed in large numbers in Paris. A great number of persons are always to be seen congregated around the distributor. Some examine it and seem to wish to divine the internal mechanism, while others cause it to operate and receive the odoriferous liquids on their handkerchiefs.—*La Nature.*

A BRAKE FOR PORTABLE ENGINES, ETC.

This device is strong and durable, can be readily applied or removed as desired, and when not in use may be stored away on the vehicle, ready for application for braking purposes on reaching a down grade. It has been patented by Mr. E. W. Cleveland, Rounthwaite, Manitoba, Canada. Fig. 1 shows the application of the improvement, Fig. 2 being a plan view. In a suitable frame is journaled a drum shaft, and two chains connected with the drum have at their outer ends hooks adapted to engage opposite spokes of one of the wheels, while the ends of the drum shaft, outside the frame, are engaged by eye bolts on oppositely extending chains hooked upon opposite spokes of the forward wheel. On the drum shaft are gear wheels meshing with pinions on a transverse shaft which has at one outer end a crank arm, whereby the drum may be rotated to tighten the chains. There are also ratchet wheels on the drum, engaged by pawls on a transverse rod having at its outer end a handle, whereby the pawls may be thrown into or out of mesh with the ratchets, when the device is locked in position upon or removed from a vehicle.



CLEVELAND'S ENGINE BRAKE.

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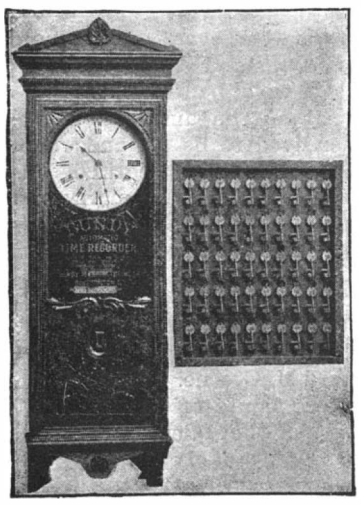
THE BUNDY AUTOMATIC TIME RECORDER AT THE EXPOSITION.

The exhibit made by the Bundy Manufacturing Co., of Binghamton, N. Y., at the Columbian Exposition, was a striking one, as is evidenced by our illustration, and the time recorder furnished by this company was the only one receiving an award, a medal and diploma being awarded it. The Bundy system was also used exclusively during the construction of the Exposition buildings, and during the continuance of the Fair, for recording the time of mechanics, clerks, laborers, etc., including all employes except the Columbian guards, who were under military discipline. For this purpose about thirty-five recorders were employed in various locations upon the grounds, besides others in different "model" establishments, as the model paper mill, model laundry, the Libby glass works, the Shoe and Leather building, etc.



THE BUNDY TIME RECORDER.

Our readers will remember that we have heretofore published a description of this improved time recorder, which is designed for use in factories, shops, stores, offices, or wherever the time of employes is required to be noted and a record kept thereof. It operates in connection with a standard clock, and the recording mechanism is arranged in a suitable casing within the clock case, below the dial, there being a central opening in front for the admission of a registering key. The clockworks are of the best variety, the Seth Thomas 100 beat pendulum movement, and the ink ribbon is in the casing with the mechanism, the reel of paper on which the record is made being just below. At one side of the clock, as shown in the small view, is an open case or keyboard fixed against the wall, in which are hung numbered keys. Each workman or employe whose time is to be taken is given a number, and in going to or departing from work he takes his key from the keyboard, inserts it in the keyhole of the recorder, turns it one quarter around, and then removes and hangs it up again. He thus records upon the paper ribbon within the machine the number of his key and the exact hour and minute of his arrival or departure. In going out he also holds down a lever projecting through the clock case on the left hand side, and a star is then printed in front of the hour record on the paper strip. The latter can be readily removed, as often as desired, for filing away, and forms a perfect and indisputable record of the workman's time. A bell rings as each record is made, thus preventing one from registering for another without detection, and after the key is inserted it cannot be taken out until it registers, neither can a second registry be made without removing the key.

At the present time, as we are informed, there are over 2,500 of these time recorders in use in various manufacturing and other industries throughout the country, where they are giving great satisfaction and paying their original cost several times over each year.

Postal Service in Interior Africa.

A five cent stamp will take one of our mammoth Sunday newspapers from this country to the white stations on the far Upper Congo. The probability is that the actual cost of delivering one of these newspapers at Stanley Falls, for instance, is twice or three times the amount of postage charged.

It is carried over the ocean about 7,000 miles before it enters Africa. It is transshipped three times before; at Matadi, ninety miles from the sea, it is placed on the back of the mail carrier who is to transport it 235 miles around the cataracts of the Lower Congo before it is placed on one of the steamers of the upper river, and the carriage becomes reasonably cheap again. Every pound of mail that goes to the Upper Congo is incased in waterproof wrappers, and for more than two weeks it is carried up hill and down, under the scorching sun and through the tropical rains, on the backs of porters; and when it finally reaches Stanley Pool the mail is sorted for shipment by one or another of the little steamboats that drop the mail packages at the government stations or the commercial posts as they thread their way among the islands for a thousand miles up the main river, for 800 miles up the Kassai and Sankuru tributaries of the south, or for 500 miles up the Mobangi affluent of the north.

All these Upper Congo stations, some seventy-five in number, isolated as they are from the rest of the world, have most of the conveniences of the modern postal service. When white men among the cannibals and the dwarfs write to their friends at home, they have the neat postage stamps of the Congo Free State to affix to the envelopes. If they wish to send money home they may procure money orders at any of the stations of the State, where, also, the orders they receive from abroad are cashed.

The only respect in which the service is deficient is that the mails are irregular, for the white pioneers often wait days and even weeks for the arrival of the mail steamer which is not only to bring them tidings from home but also the stores which they need in carrying on their work.—*Pittsburg Dispatch.*

African Ants.

Dr. Sharp gives the following extract from Dr. Livingstone's "Narrative of an Expedition to the Zambesi:" "We tried to sleep one rainy night in a native hut, but could not because of attacks by the fighting battalions of a very small species of *Formica*, not more than one-sixteenth of an inch in length. It soon became obvious that they were under regular discipline, and even attempting to carry out the skillful plans and stratagem of some eminent leader. Our hands and necks were the first objects of attack. Large bodies of these little pests were massed in silence round the point to be assaulted. We could hear the sharp, shrill word of command two or three times repeated, though until then we had not believed in the vocal power of an ant; the instant after we felt the storming hosts over head and neck."

A NEW STORAGE BATTERY

It seems to be a well established fact that the efficiency of electric lighting stations can be greatly increased by the addition of a suitable storage battery plant, which will utilize the surplus energy of the engines, so that they can be run continuously at their maximum load, consequently securing the greatest economy. In Europe, the practice of using storage batteries during the day which are charged by the dynamos the latter part of the night is becoming common. To some extent the same thing has been done in this country. In Paris, the Popp Company, operating twenty-five sub-stations, employs a storage battery at each station having a capacity of from two to three thousand ampere hours, and feeding over 100,000 lamps. In Germany and England the same thing is seen; in Hanover 20,000 lamps are operated by storage batteries; Dusseldorf, 20,000; Bamberg, 2,700; Darmstadt, 5,800; Hamburg, 12,000; Elberfeld, 14,000, and so on. These sub-stations are all supplied with the chloride type of storage battery, similar to that which we here illustrate.

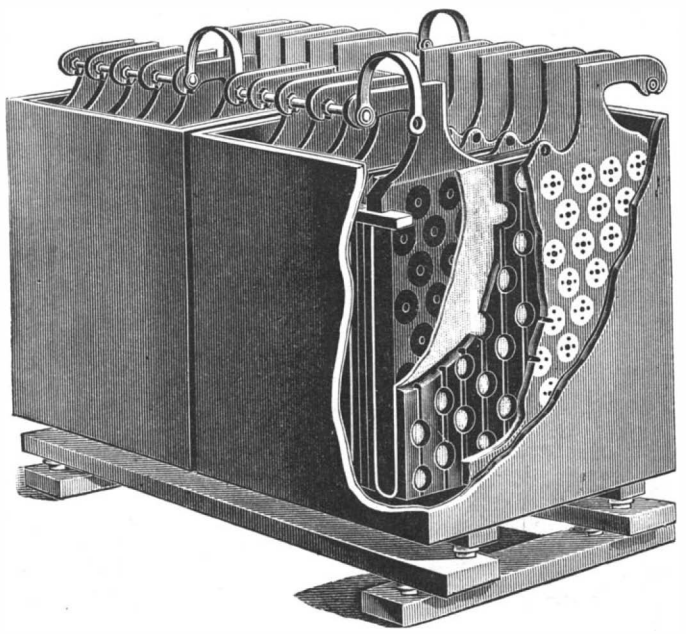
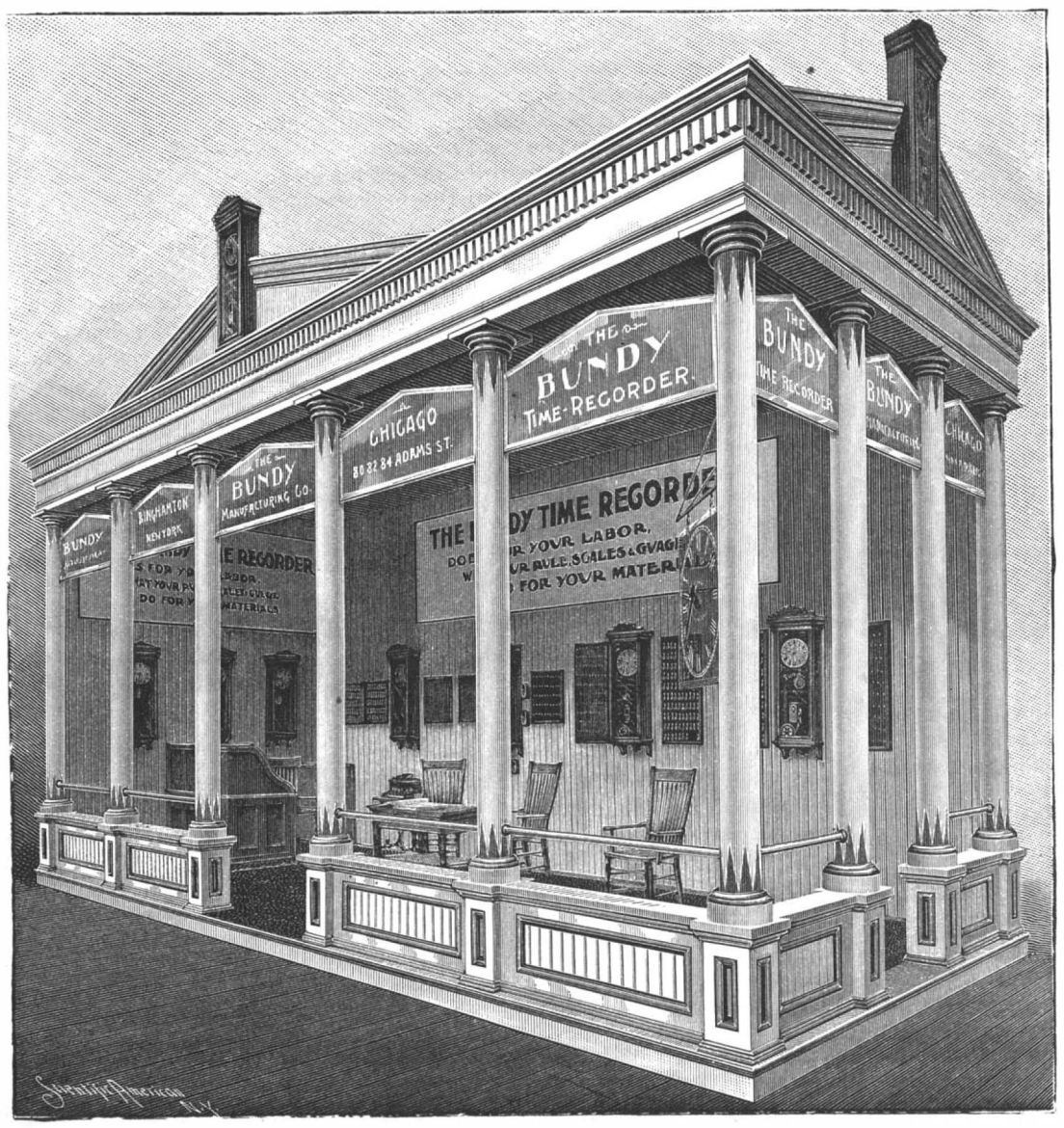


Fig. 1.—NEW STORAGE BATTERY.

The Electric Storage Battery Company, of Philadelphia, is introducing in this country the chloride accumulator, and have established works at Gloucester, N. J. The elements of the chloride battery are made of tablets cast from fused chloride of lead and zinc, which are held together by a frame or rim of antimonious lead. The tablets which compose the plates are subsequently converted into active material of perfect character by electrical action. The crystals which are formed in this manner are needle-shaped, running through the plate perpendicular to the surface. By the elimination of the chlorine, innumerable minute cells are formed around these crystals, giving an enormously extended surface, which is essential for the great capacity. This material is entirely different in character from the ordinary active material which is mechanically applied, and it has proved itself to be much more durable, uniform, and efficient.

Fig. 1 is a perspective view of a pair of accumulator cells, with parts broken away to show the interior, and Fig. 2 is a side view of the accumulator plates. The reduction of these plates requires from 12 to 24 hours. Every trace of chlorine is finally removed by washing the plates in running water, after which they are charged continuously for several weeks, until the crystalline spongy lead has been completely converted into peroxide. The negative plate of the battery is separated from the positive plate by a separator, S, made of wood soaked in insulating compound and perforated and grooved longitudinally to permit of the free circulation of the electrolyte. The positive plate is made considerably heavier than the negative plate, and is surrounded by asbestos



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE BUNDY TIME RECORDER.

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cloth, which incloses the tablet of the plate and prevents short-circuiting by confining the active material to its place.

The capacity of the chloride cells is from 5 to 6 ampere hours per pound, with a discharge rate of one-half ampere for each plate. Notwithstanding this high capacity and the high rate of discharge, the efficiency of the cell is very high, the loss in current being less than 10 per cent, and the watt efficiency is from 75 to 85 per cent.

A large plant of chloride cells having a capacity of 1,894 ampere hours has been placed in the Provident Life and Trust Company's building in Philadelphia, which, on a recent test, exceeded by nearly 50 per cent the guarantee given by the company. The chloride battery plant, used in connection with the Germantown, Pa., electric lighting station, has a capacity of 1,000 ampere hours, which is soon to be doubled.

This battery has been found to be efficient in traction work. Thus two sets of chloride batteries of ninety-six cells each have been in use on the Metropolitan Railway at Washington since last April. The car has run 8,000 miles and has been run for three days continuously, while the batteries have remained unchanged.

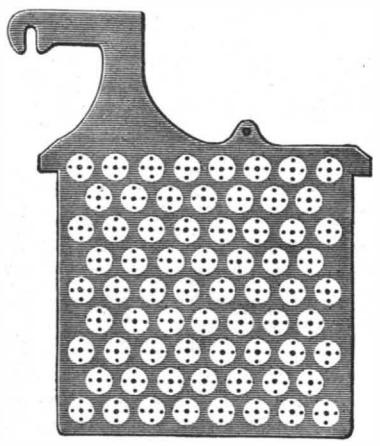


Fig. 2.—CHLORIDE ACCUMULATOR PLATE.

Storage batteries diminish in capacity with increased discharge, so that when cells are called on for heavy rates of discharge, this feature becomes one of importance where economy is a consideration.

Fig. 3 is a diagram of curves showing the capacity of the chloride accumulator under these varying conditions. These curves show the results of various tests. It will be seen by comparing the different results that in every case there is shown to be a difference in capacity of only ⅓ between the lowest and the highest rate of discharge. Thus, while the smallest element, weighing 50 pounds, has a capacity of 320 ampere hours when discharged in 24 hours, its capacity is still as high as 210 ampere hours when discharged in four hours, which is six times its previous rate.

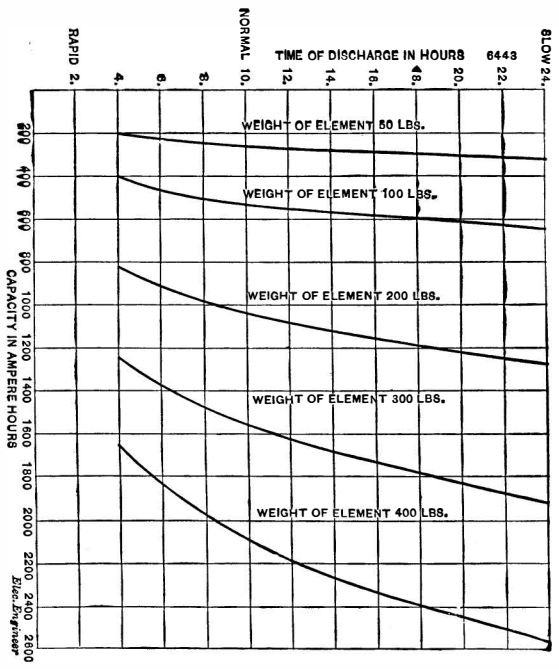


Fig. 3.—CURVES SHOWING CAPACITY OF PLATES.

We understand that the largest storage batteries in the world are being made on this principle. As to the matter of durability, the manufacturers claim, and users testify, that this cell is practically indestructible. Further particulars regarding the chloride accumulator may be procured from the Electric Storage Battery Company, W. W. Gibbs president, Philadelphia, Pa.

Physical and Chemical Ingredients of a Man.

A notable object of interest is described as among the contents of the National Museum, Washington, showing the ingredients which go to make up the average man, weighing 154 pounds. A large glass jar holds the ninety-six pounds of water which his body contains, while in other receptacles are three pounds of "white of egg," a little less than ten pounds of pure glue, thirty-four and one-half pounds of fat, eight and one-fourth pounds of phosphate of lime, one pound carbonate of lime, three ounces of sugar and starch, seven ounces fluoride of calcium, six ounces phosphate of magnesia and a little ordinary table salt. The same man is found to contain ninety-seven pounds of oxygen, fifteen pounds of hydrogen, three pounds and thirteen ounces of nitrogen, and the carbon in such an individual is represented by a foot cube of coal. A row of bottles contain the other elements going to make up the man; these being four ounces of chlorine, three and one-half ounces fluorine, eight ounces phosphorus, three and one-half ounces brimstone, two and one-half ounces each of sodium and potassium, one-tenth of an ounce of iron, two ounces magnesium, three pounds and three ounces of calcium.

Lemons and Oranges.

The Florida lemon season, which commenced early in September, is about ended. Only a small portion of the crop, estimated variously at from 25,000 to 50,000 boxes, came to this city. The percentage of handsome Florida oranges has been small, the bulk being rusty or "horny," and prices have been unsatisfactory to the growers. The average freight on a box of lemons from Florida to New York is fifty cents, while from Sicily the cost for transportation is but thirty-two cents, with duty amounting to as much more. The railroad charges from California on a similar package are eighty-seven and a half cents, but the crop in California is small, and as yet only specimen lemons have been seen here. Nearly three million boxes of lemons came into the United States from Mediterranean ports during last year. The lemon season with local dealers begins November 1, when the first new Sicily lemons are due, and continues the year through. While the over-importation of Mediterranean lemons last year has left a large supply of old stock on hand, there are just now no good lemons to be had here. During November of last year 120,000 boxes of new-crop Sicily lemons were sold in New York, but none have yet reached this port this season. The first cargo of Messina lemons is, however, expected daily, and another steamer, carrying above 20,000 boxes of the same high grade, is due in a few days. The crop of Florida oranges this season is the heaviest known, a conservative estimate being 4,500,000 boxes, while it is believed by other authorities that 5,000,000 boxes will go out of that State. The weather in Florida during the summer was highly favorable for the development of the fruit, and many young groves are coming into bearing for the first time. The fruit is ripening earlier than it has for several years past, and is reaching this city in heavy quantities, but prices are very low, due to decay caused by recent rains. Recently there arrived, besides large quantities of the fruit bound for other points, about 60,000 boxes, while but a few days previous 42,000 boxes were thrown on this market. The heaviest receivers are the Florida Fruit Exchange, who sell the product of above 8,000 growers at auction. An average price of recent sales is $1.60, and this nets the grower but sixty-five cents a box on the tree, the return heretofore having been about a dollar a box. Since the middle of September 25,000 boxes of Florida oranges have been sent to England by the exchange, with generally satisfactory results.

Legal Uses of Photography.

The legal uses of photography were shown by the testimony of Mr. Spencer, the photographic expert of Washington C. H. The case was the famous Stubblefield-Munford controversy, which has been dragging through the courts of Fayette County for years. The litigation involves 1,500 acres of the finest farming land in Fayette County.

During Monroe's administration this tract was willed by one of the old Munfords to his five heirs, and the present suit was brought on the deed of sale signed by them. The Munford heirs deeded the land to Stubblefield, who afterward sold parts of it to different parties, who have had to pay twice for their land by decision of court.

The case the other day was an appeal asking a new trial in order that new evidence may be introduced. The new testimony is the photograph of the original deed of sale made by Mr. Spencer. All previous decisions have been made in favor of the Munford heirs on the ground that Anna Munford, one of the original five heirs, had never signed the deed to the Stubblefields.

The deed of sale, discolored and yellow with age, was taken to Mr. Spencer by the attorneys for the defendants. The closest examination failed to disclose any evidence of more than four signatures, and only the fact that the space for the fifth remained caused the attorneys to think that it had once existed.

Under the closest watch of the clerk of the court, who could not allow the original to leave his hands, Mr. Spencer photographed the deeds. On the plate he saw traces of the signature, and, on enlarging the negative ten times, the entire name was as plainly seen as when first written. The presiding judge was much interested in Mr. Spencer's evidence, and left the bench that he might more closely examine the negatives.—*Cincinnati Tribune.*

Recipe for the Attainment of Old Age.

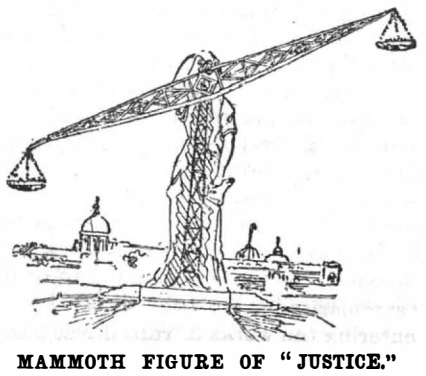
"The reason I have lived so long and kept always so well and hearty," said recently Miss Eliza Work, of Henrietta, N. Y., who will be 100 years old if she lives six weeks longer, "is because I never drank tea or coffee, and, above all, never got married."

Miss Work keeps house for her nephew, George W Lincoln, and keeps no help. She was born at St. Johnsbury, Vt., on January 8, 1794, and came to Monroe County eighty years ago with her brother. At the age of 91 she traveled alone to her native place, and declares that she was not a bit tired, either going or returning.

"I have done a big day's work every day for more than ninety years," she says, "and I expect to do a great many more. I have never had occasion to use spectacles yet, and my teeth are the same teeth I have always had. My brother lived to be 101, and would have lived much longer if he had never married. He drank coffee and tea, too. People who marry and drink coffee and tea ought not to expect to live very long."

A NOVELTY FOR THE MIDWINTER FAIR.

Among the applications for permission to make novel exhibits at the coming midwinter fair in San Francisco is one by Edward M. Greene. It is a mammoth scales of Justice. The figure of Justice is 150 feet high. The cross beam of the scales she holds in her hand is 300 feet long. Each scale is a car capable of holding fifty people, who may be carried to a height of 288 feet. The whole arrangement is to be manipulated by machinery placed beneath the base of the statue. There is telephonic communication between each car and the engine room and everything may be regulated smoothly and quickly. The *Chronicle* thinks there is no doubt that the statue would make a unique display and might perhaps share the honors with the electric tower.



MAMMOTH FIGURE OF "JUSTICE."

The Search Light in Warfare.

The Spanish cruisers Alfonso XII., Conde de Venadito and Melilla steamed on the night of November 13 near the Moorish encampment, not far from Melilla, and at about 11 o'clock suddenly illuminated the whole country around, taking the Moors by surprise and pouring shells upon them with unerring accuracy by the light of the powerful lamps. A terrible cannonade continued from the ships and the forts the remainder of the night, and according to the report many were killed. The lights seemed to have terrified the Riffians fully as much as the destruction that followed, for they offered no opposition, but ran about like madmen seeking shelter in caves.

A Word to Mail Subscribers.

At the end of every year a great many subscriptions to the various SCIENTIFIC AMERICAN publications expire.

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Treating the Sewage of a Large City.

Glasgow is now resolutely grappling with its sewage problem, a difficulty which, sooner or later, every city, large or small, is compelled to face. The efforts to satisfactorily solve what has been aptly described as the puzzle of the sanitarian and the despair of the engineer may be viewed on broader lines of interest, says *Industries*, than on the merely local grounds connected with the municipal affairs of that city. For full half a century the legislators of Glasgow, though inactive, have been keenly alive to the importance of the problem. It is now nearly forty years ago since the opinions of Sir Joseph Bazalgette, Mr. Bateman and Professor Anderson were sought; while in 1874 Sir John Hawkshaw, as royal commissioner, took the matter up, and reported fully on the whole scheme. Nothing, however, was done, and to this day—though the imperative necessity of action is as fully admitted as fifty years ago—the Clyde remains, to put matters plainly, a huge open sewer—a fact which fully demonstrates itself with every recurrence of warm weather, more especially if accompanied by drought.

Turning to the various modes now in vogue for sewage disposal, the first, viz., gravitation, is considered quite impracticable for Glasgow, owing to the strenuous opposition offered all along the coast to any project which, by detracting from the amenity of the neighborhood, might in the least degree depreciate the value of residential property. The second method—irrigation—is, for a variety of reasons, deemed hopeless in Glasgow; while a third mode, viz., filtration, has been likewise discarded, on the ground of excessive cost.

The only feasible course open to Glasgow appears, therefore, to be that of precipitation, and the first practical effort to solve the problem by chemical treatment will be watched with keen interest not merely by those locally concerned, but also by sanitarians of every shade of opinion throughout the kingdom. Parliamentary powers were sought and obtained in 1891, and some 30 acres of land at Dalmarnock were acquired for the erection of works capable of dealing with about one-fifth of the sewage of Glasgow. Mr. G. V. Alsing, who has had valuable experience at Bradford and Sheffield with the system adopted, was appointed engineer, and early last year the tender of Messrs. John Goldie & Son, contractors, for the sum of £45,000, was accepted, and the work is now in course of execution. The mode in which the sewage will be dealt with may be briefly summarized as follows:

On entering the works it runs direct into the catch-pits, where the heavier constituents are precipitated by gravity, and removed by the same agency into sludge tanks, whence in the form of cakes, moulded in presses by compressed air, it will be utilized as manure for agricultural purposes. The lighter and more aqueous flow from the catch-pits will be lifted by centrifugal steam pumps into the mixing chamber, where the chemicals—sulphate of alumina and milk of lime—are added for precipitation of the sewage. The liquid then passes into the precipitation tanks, twenty-four in number, each 45 ft. by 50 ft. by 6 ft. in depth, and with a capacity of 80,000 gallons. The work of separation over, the fluid on the surface is emitted through self-floating valves—the invention of Mr. Alsing—into a corresponding number of aerating tanks of similar dimensions. The effluent is then discharged as a clear and colorless stream into the Clyde, after filtration in sixty filters covering some three acres of ground.

When in full operation ten million gallons of sewage will be treated every 24 hours; while provision is made for extensions capable of dealing with double that quantity. The total estimate, inclusive of land, is £100,000. The authorities of Glasgow have to cope with fifty million gallons of liquid sewage per diem, in addition to 1,000 tons of solid refuse; and any system which promises to aid them in their arduous duties and to purify the Clyde will be watched with keenest interest on all hands. This river at present is in a condition which most adversely affects the steamboat companies who make Glasgow their port.

Ten Miles Above the Earth.

One of the most interesting experiments with balloons that has ever been undertaken was that of Messrs. Hermite and Besancon, at Paris-Vaugirard. They succeeded in sending a balloon to the unprecedented elevation of 16,000 meters, or about 10 miles. There were no people in the balloon, but it carried a variety of self-registering instruments designed to record the temperature, the atmospheric pressure, etc. The little balloon was started on its lofty trip about noon, when the air was remarkably still and clear. It rose rapidly, and in three-quarters of an hour had attained an elevation of 10 miles, at which height it remained for several hours.

It was there subjected to an atmospheric pressure only about one-eighth as great as that at the surface of the earth, and M. Hermite explains its floating for so long a time at a constant height by supposing that the temperature does not vary sensibly with the elevation of the floating body after the latter has attained an altitude where seven-eighths of the atmospheric pressure is lacking and where there remains no trace of water vapor.

But toward 6 o'clock, when with the decline of day the temperature began rapidly to fall, the balloon started back toward the earth, arriving with a gentle motion which did not disturb the instruments it carried, at 7:11, at Chanvres, near Paris-Vaugirard, from which it had started.

The balloon was visible with a telescope during the entire time. It shone like the planet Venus seen by day. By means of a micrometer attached to an astronomical telescope the apparent diameter of the balloon could easily have been measured, and this would have furnished a means of calculating its altitude independent of the record of the barometer which it carried.

The barometer and thermometer were furnished with automatic pens driven by clockwork, by means of which diagrams of the changes of pressure and temperature that the balloon experienced were obtained. At the height of about 7¾ miles the thermometer marked a temperature of 60 degrees Fahrenheit below zero. Then the ink in the registering pens of both the thermometer and the barometer became frozen and the records were interrupted.

But, as the balloon continued to rise, the ink thawed again, and at the ten-mile level the automatic records were renewed. The temperature registered there was only about 6 degrees below zero. The increase of temperature is ascribed to the effect of the unclouded sun heating the air in the basket that contained the instruments. The lowest record of the barometer was 103 millimeters, or a trifle more than four inches.

M. Hermite calls attention to the fact that the density of the air at the height of ten miles, where the balloon remained during most of the afternoon, is less than that existing upon the plains of the moon, on the assumption that the atmospheric density on the moon is proportional to the force of gravity at the surface of that orb.

If this is correct, then the instruments would have behaved about the same if M. Hermite had been able to place them on the moon as they did when he sent them only ten miles above the earth.—*Youth's Companion.*

Chinese Silver Ware.

The extraordinary popularity of silver for ornaments in China is referred to thus by the American consul at Amoy: "Silver is to the Orient what gold is to the west. To the artist, the scholar, and the collector it is the king of all the precious metals. Its popularity is not due to its cheapness. Jade, which rivals silver in public esteem, is much more expensive than gold. There may be another reason for the small use of gold as an ornament by the Chinese. In designation of rank and title a gold button stands at nearly the bottom of the list. Then, on the other hand, golden yellow is the imperial color, and none but those around the Son of Heaven are allowed to use it for wearing and other purposes." Silver jewelry and curios in China are universal: the poorest coolie's wife has usually silver bracelets and earrings. In curios and bric-a-brac the number of silver articles is legion.

The greatest manufacturing center is Canton, but Amoy, Foochow, Nanking, and Pekin possess artists and guilds whose workmanship is famous all over the empire. One class of designs consists of miniature reproductions of features of daily life, and is adapted for earrings and watch charms. Among the most familiar objects are the pagoda, sampan (or native boat), junk, the sedan chair, the small-footed lady's shoe, the Goddess of Mercy, the Celestial Poodle, the King of the Fishes, the sitting Buddha, the dragon, the flying serpent, the begging priest, the tiger, lion, horse, pig, buffalo, elephant, turtle, crocodile, monkey, cat, and dog. The largest does not exceed two inches in length, and they diminish to dainty little objects no larger than a grain of corn. The work and finish are admirable, the features and hair of the human beings and animals and the scales of the fish and crocodiles being reproduced with the highest care and skill.

Another class consists of imitation cordage. The metal is solid, but the surface is so cleverly wrought out that at first sight each piece seems a rope, cord, or braid. Some are as fine as sewing silk, while others are as thick as clothes lines. The silver is alloyed with a small percentage of copper to increase its hardness and to allow the fine carving and engraving impossible in the softer substance of pure silver. These silver cords are used for bracelets, anklets, necklaces, belts, sword hangings, and horses' harness. Though stiff, they are not rigid, and can be bent in every direction. A third class comprises household ornaments, such as match boxes, ash cups, joss sticks, bowls, sandalwood urns, plates for opium pipes, button boxes, and so on without end. They are of the same general type and about the same value as those made in America and Europe. A fourth class includes filigree work and tissues made from fine silver wire, and is marked by the highest skill and beauty. It is, and has been for centuries, a favorite kind of work among the Chinese. There is but little doubt that Marco Polo brought specimens of it to Europe from Nanking, and in this manner aided in the after development of the guilds of Italy and France. The designs sometimes are marvelous. One from Foochow consisted of a bouquet, over which was loosely wrapped a silken veil. It was so perfectly made that the veil looked as if it might blow away at any moment. Through its flimsy folds the flowers and leaves were all visible. Another artistic gem was a little bouquet in which ferns, lilies of the valley, and similar botanical beauties were perfectly photographed in metals.

In selling his goods the Chinese merchant in silver ware gives the weight of the metal, its fineness, and its value as bullion, and then as a separate item the cost of the workmanship. Thus a bill for a pair of corded bracelets was as follows: Silver (4½ ounces 85 per cent fine), $4.20 (Mexican); workmanship, $2.15; total, $6.35 (Mexican). The first item is mathematically correct, and can be depended upon as the intrinsic value of the material used in the manufacture.

Pittsburg Natural Gas Supply.

Concerning some new and large gas wells, whose supply is intended for Pittsburg, the *American Manufacturer* says:

The Swagler well No. 1, struck about a month ago on Jacob Swagler's farm, in Somerset Township, Washington County, twelve miles east of Washington, Pa., is regarded as the largest gas well in the world. It belongs to one of those private lines laid by Pittsburg manufacturers, and was drilled by the Monongahela Natural Gas Company, which was organized four years ago with a capital stock of $1,000,000. It is stated that the gas started in the fifth sand, at a depth of 2,700 feet, and its roar was heard fifteen miles away. The drillers worked with cotton in their ears and communicated by signs. The Monongahela Company had thirty-two wells in that field, but all were plugged, in order to use the product of this one great gusher. The Monongahela Company is composed of H. W. and David B. Oliver, of the Oliver Iron and Steel Company, and some of the stockholders of the Republic Iron Works. A short time since the Somerset Township leases of Monongahela Company, including but one well, the Swagler, was sold to the Philadelphia Company, and it is now sinking five other wells.

About two weeks ago the Philadelphia Company, of Pittsburg, which virtually controls by lease and traffic arrangement the business of supplying natural gas fuel to private residences in Pittsburg and Allegheny, brought in its 913th gas well. This well is located in the Monroeville field, thirteen miles from Pittsburg. This company has eleven first-class wells in reserve, ten being located in South Buffalo Township, Armstrong County, twenty-eight miles north of Pittsburg. The company's experts say natural gas will be found as long as oil, and its supply has been ample for thirty years, but it may have to be piped long distances. The original gas fields of Murrysville and Grapeville, in Westmoreland County, are running low, but substitutes have been found, the drillers having made a complete circuit of Pittsburg within a radius of thirty miles during the last seven years.

Simultaneous with the success in Washington County, south of Pittsburg, was the discovery of natural gas in a westerly direction in New Sewickley Township, Beaver County. This is about twenty miles distant from Pittsburg. At the usual depth no gas was found, and the wel lwas drilled 500 feet deeper, when the gas forced its way to the surface with such a pressure—300 pounds—as to blow out the packing.

Wooden Water Mains.

A recent paper read before the American Society of Civil Engineers by Mr. James D. Schuyler, M. Am. Soc. C.E., on "The Water Works of Denver, Colo.," contained some very interesting observations and figures relating to this subject. He states that 16 miles of 30 inch wooden conduit were constructed in that work in addition to a considerable length of 44 inch pipe. The timber used was California redwood, and the 30 inch conduit was constructed to stand under a head of 185 feet. We understand from the paper named that the total average cost of the 30 inch pipe was $1.36 per lineal foot, of which about forty-eight cents constituted the cost of trenching and back filling. A gang of eight to sixteen men laid from 150 to 300 feet of the same size conduit per day. These mains were composed of staves, dressed very smooth to cylindrical sides and radial edges, and were held to the cylindrical form by mild steel bands placed at a distance apart depending upon the head, but never exceeding 17 inches. The pores of the wood are filled with the water under pressure so that it oozes through to a slight extent, thus realizing the condition for permanent preservation. The pipe is framed in the trench and all handling in full size sections is avoided; at the same time the interior finish is so smooth that the most advantageous conditions of flow are secured.

Mr. Schuyler estimates that the use of these wooden conduits effected a saving of over $1,000,000 in this particular work.

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THE BROADWAY CABLE RAILWAY.

The spacious and handsome cable cars, as they now move up and down Broadway, are in marked contrast with the former horse cars, and when the old days of the Broadway stages are remembered, the transformation seems wonderful. Where there are no horses, no trolleys, no storage batteries, no visible means of propulsion, it becomes a question of interest as to where the power is generated, how it is transmitted, and how it is used in the propulsion of the cars.

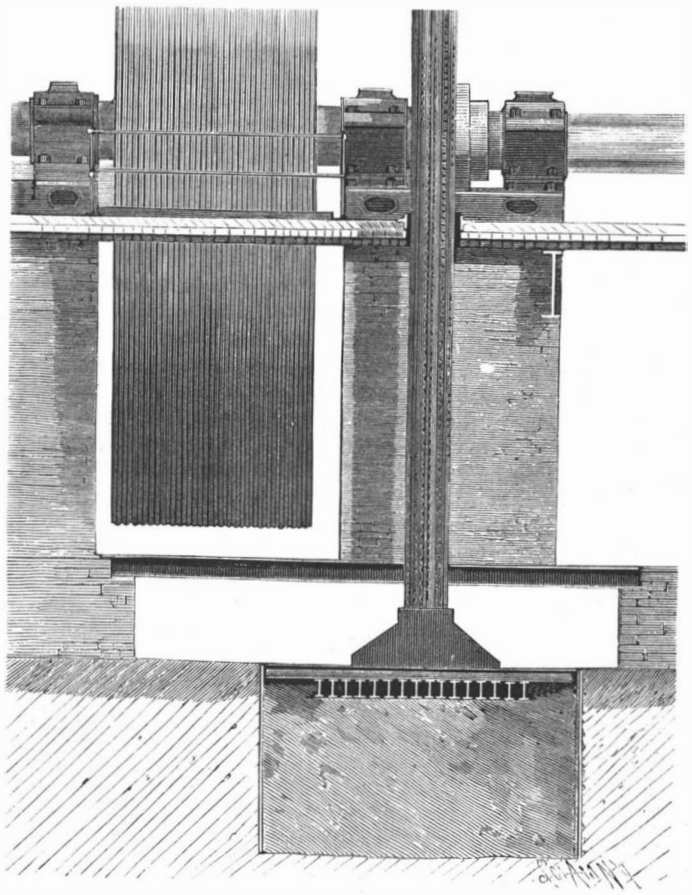
We have from time to time printed accounts of the progress of this great work, so that, so far as the practical details of the working of the road are concerned, our readers have had an opportunity to become informed. Our diagram shows the different loops of the cable. From 59th Street to 36th Street, the cars are propelled by cables running from the 51st Street power station; from 36th Street to Bowling Green, the cars are propelled by cables running from the Houston Street power station; and from Bowling Green to the ferries, the cars are to be propelled by a loop running out of the Front Street power station. The several loops of the cables are lettered A, B, C, etc., on the diagram. The loop at the Battery is a single cable, to which the cars from the main section will be transferred.

The Houston Street power station is provided with two pairs of duplicate engines, arranged for driving four separate cables, the loops B and C extending to Bowling Green and the loops D and E extending to 36th Street. As will be seen by the diagram, these cables are in duplicate, so that should one fail the cars may be easily thrown in connection with the other, and the engines are arranged so that any loop may be driven by any engine in the station. The loops G F, running out from the 51st Street power station, are arranged in practically the same way. The 51st Street power station has already been described in these pages. The Front Street power station is not yet completed.

The Houston Street power station forms the subject of our engravings. It will be found difficult, on making a search at the corner of Houston Street and Broadway for the power station, to determine which of the corner buildings contains the engines and boilers for driving the central loops of the railway. The building which stands upon the northwest corner has every appearance of being an ordinary business building, and such it is from the ground floor to the roof; but the structure below the ground floor differs materially from other buildings on Broadway. It has a double foundation, or rather, it has a foundation which is separate from the foundations of the engines and machinery in the basement. The smaller engraving shows the construction of this part of the building. It represents one of the large steel columns which support the superstructure. It will be seen that it passes through the floor of the engine room and is entirely independent of this floor. By means of this construction any possible vibration of the machinery is confined to the engine floor and not transmitted to the columns which support the building. The engines, four in number, are supported on brick piers, rising from the bottom of the sub-cellar. The engines are arranged in two pairs, connected with the driving drums, as shown in the upper portion of the front page engraving. The engines, which are 1,200 horse power each, were made by the Dickson Manufacturing Company, of Scranton, Pa. The cylinders of these engines are 38 inches in diameter, the stroke 60 inches. Each engine of each pair has a flywheel, and is arranged for connection with a rope-driving drum, common to both engines, by means of a slot and key coupling. The engines are of symmetrical design, but calculated more for strength and efficiency than for beauty. They are of the Corliss type, but with a modified cut-off. The driving drum is 26 feet in diameter and 5 feet wide. It is provided with twenty semicircular circumferential grooves for receiving the 2 inch cotton ropes, which drive a drum of the same description on a 20 inch shaft extending entirely across the engine room, and carrying another rope drum opposite the driving drum of the other pair of engines. This shaft is made in four sections, each end section carrying a 26 foot drum, already described, and one 9 foot drum, grooved for thirty-four 2 inch cotton ropes, which run from these drums over 32 foot drums on the cable-driving shafts. The 9 foot drums are connected with the shaft by means of friction clutches, so that these drums may be connected with the power or thrown out of gear at pleasure.

The middle portion of this shaft is divided into two parts, which may be connected with each other, so as to make the shaft continuous, and each also carries a 9 foot drum. At the middle of the shaft is arranged a small engine, which is connected with each half of the shaft by spur gearing. This engine is intended for turning over either half of the shaft and the machinery connected therewith for inspection and repairs. The shafts which support the 32 foot drums carry at opposite ends cable drums for driving the cables which run out into the street and propel the cars. Each half of the plant is furnished with two cable-driving shafts, each of which carries a 32 foot drum, taking power from a 9 foot drum on the 20 inch shaft, and each cable passes four times around the pair of cable drums to insure the necessary friction for driving. The outgoing part of each cable passes around a sheave carried by a tension car in the lower basement, before running up to the conduit. Each tension car has a run of about 40 feet on a railway track laid in the sub-basement, and it is drawn in opposition to the pull of the cable by a weight of about 2 tons attached to a 1 inch rope running up over a sheave attached to the first floor of the building. All of the engines may be run simultaneously, thus driving all four of the cables, or they may be run independently, or either set of cables can be run by either engine, thus allowing for any contingency.

The Heine boilers, twelve in number, which supply steam to the engines are placed in the rear basement. They are of the water tube type, and are arranged in two batteries of six each. Each boiler may be used independently of the others. The coal used in the furnace is stored in bunkers under the street, and auxiliary bunkers are provided below the boiler floor. The plant is provided with a complete electrical outfit for lighting the engine and boiler rooms, as well as the rest of the building.



THE FOUNDATIONS.

As our readers are well aware, Mr. John D. Crimmins, one of New York's best known contractors, was the builder of the road, almost all of the material, both for street work and power plants, being furnished by the Pennsylvania Iron Works Co. Both the design of the road and its construction have been under the direction of Major G. W. McNulty, the engineer-in-chief. His assistants have been H. W. Brinckerhoff, in general charge of the office; N. S. Latham, Albert Carr, A. N. Connett, and G. F. Simpson, division engineers in immediate charge of construction; M. W. Sewall, in charge of design of power plants, and C. I. Earll, in charge of design of track work, including grip and curve mechanism.

The Third Avenue cable road, which has been in process of construction for several years, is now practically completed and was officially opened last week. Cars are now running regularly on the upper portion of the road. This road differs from the Broadway and Seventh Avenue road in respect to its engines, cars, grip and grip-operating devices; also in other important particulars.

Early Use of Petroleum.

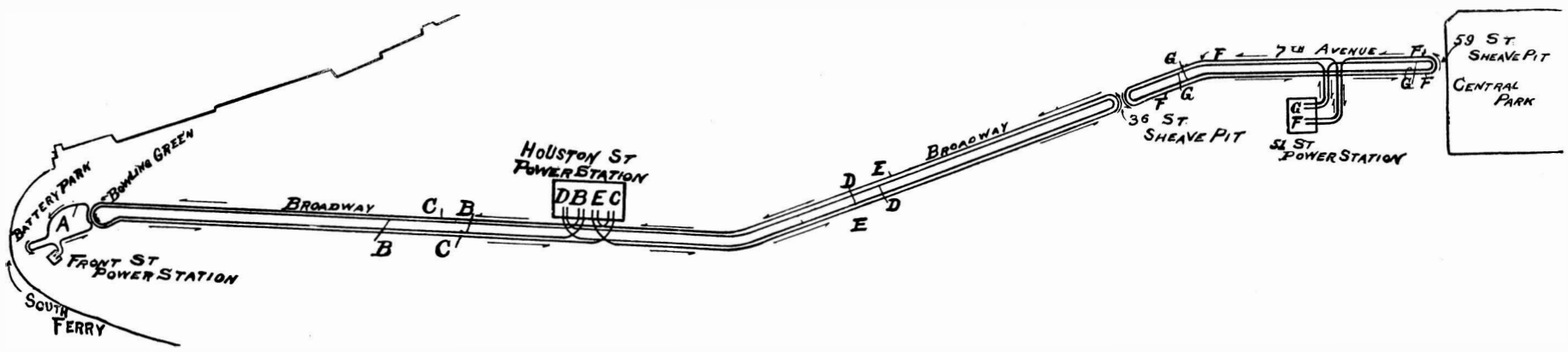
In a diary kept by one of the surveyors engaged in the survey of the Holland Land Company's purchase, at the very beginning of this century, an entry occurs to the effect that near the headwaters of the Allegheny River, in New York State, was a spring, upon the waters from which, when conducted into shallow pools, would collect quantities of oil. This the Indians collected and used. For unknown generations the Indians held this spring in high veneration, believing it was a direct gift from the Great Spirit. They dried the oil by exposure to the sun, and made an ointment that they used to mix their war paint, as well as for remedial purposes. This ointment was the vaseline of the present day in its crude state, for the oil skimmed from the spring was crude petroleum. The old spring and a plot of ground one mile square were given to the Indians as a reservation, and is so held at the present time, being known as the Oil Spring Reservation.

In after years, the enterprising whites collected the oil, and it was bottled and sold under the name of "Seneca Oil." It had a wide reputation, and was eagerly sought by many, who extolled its merits in the most extravagant terms. Had it not been for the fact that the inquisitive whites found a way to get petroleum from the earth by sending the drill down through the rocks, "Seneca Oil" would doubtless now be a popular medicine worth $1 a bottle.—*Pharmaceutical Era, Detroit.*

The Ignorance of Children.

By the liberality of Mrs. Quincy Shaw I was enabled to make comprehensive studies in 1880 of a large number of Boston children just after they had entered the lowest grade of the primary school. Fourteen per cent of these six-year-old children had never seen the stars and had no idea about them; thirty-five per cent had never been into the country; twenty per cent did not know that milk came from cows; fifty-five per cent did not know that wooden things came from trees; from thirteen to fifteen per cent did not know the colors green, blue, and yellow by name; forty-seven per cent had never seen a pig; sixty per cent had never seen a robin; from thirteen to eighteen per cent did not know where their cheek, forehead, or throat was, and fewer yet knew elbow, wrist, ribs, etc. More than three-fourths of all the children had never seen to know them any of the common cereals, trees, or vegetables growing.

These subjects were chosen because most of them constitute the material of school primers or elementary instruction which this new science of ignorance shows must make mere verbal cram of much matter of instruction. What idea can the eighteen per cent of children who thought a cow no larger that its picture get from all instruction about hide, horns, milk, etc.?—*Pres. G. Stanley Hall, in the Forum.*



ROUTE OF THE BROADWAY CABLE RAILWAY, NEW YORK.

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UNITED STATES LARGE CALIBER MORTARS.

Among the government exhibits at the Columbian Exposition, Chicago, were modern mortars, showing the many improvements which have been adopted within the last few years. We illustrate one of these great weapons, which was seen at the Fair, mounted upon a Canet carriage. The old-fashioned mortar was about as simple a device for war purposes as could be made, but not very accurate in its delivery. It was chiefly operated by guesswork, and its results were apt to consist more of noise than disaster.

The additions of modern machinery have greatly contributed to the accuracy of firing, and this now renders the weapon very formidable. By the use of hydraulic cylinders the recoil is so taken up that the direction of the shot is not disturbed by the recoil, while the elevating, lowering and revolving mechanism is of such a nature that the aiming of the mortar is accomplished with the utmost rapidity and accuracy. For harbor defense these mortars are of especial value. It is believed that no vessel afloat could endure the explosion on its deck of one of the great shells which these mortars deliver. A 12 inch mortar, for example, throws a shell weighing over 600 pounds. It is hardly possible to plate the deck of a war ship sufficiently thick to withstand such a missile.

Increase in the Height of Englishmen.

Francis Galton has collected some interesting facts in regard to the effect of athletics and improved physical conditions during the last forty years on the physique of the middle classes.

When he was an undergraduate at Cambridge, from 1840 to 1844, although but 5 feet 9¾ inches in height, he was taller than the majority of his fellows. In addressing them he habitually lowered his eyes, and if in a crowd he could readily see over the heads of the people. Writing in 1893, he states that he no longer possesses these advantages.

Altered social conditions, in his opinion, have helped to improve the bodily powers and address of this class; such conditions, for instance, as more wholesome and abundant food, better cooking, warmer clothing, moderation in the use of alcohol, better ventilated sleeping rooms, more change through vacations, and, lastly, the healthy lives led by women in their girlhood. One of the most striking sights in the city of London is the number of tall women that are to be found in the fashionable parks during the season.

It is more particularly among the women of the upper classes that the improved conditions of the last two generations have left their mark. Women of 5 feet 6 inches and 5 feet 8 inches are common, and it is not a very unusual occurrence to meet a woman of 5 feet 10 inches and even 6 feet. A gentleman well known in London society states that when he became of age, twenty-two years ago, his sister, a tall and handsome girl, was the tallest girl among the visiting acquaintances of the family, and now she is overtopped by nearly every one of her younger lady acquaintances.—*St. Louis Globe-Democrat.*

The Cause of Diphtheria.

Diphtheria is due to a fungoid growth. Yet its mode of dissemination is still among the obscurities of science. Water does not seem to spread it, and, contrary to the general impression, it is uncertain whether bad drainage, unless by producing a low condition of the system favorable to attacks of any malady, has much connection with it. This was the opinion of Sir William Jenner many years ago, and it is the conclusion of Dr. Thorne still. He connects it with the crowded condition of the board schools, where many of the "sore throats" for which the children are not kept at home are suspected of being something much more serious. At Enfield the spread of the epidemic was put upon the cats, which, ever since Darwin charged them with being accessory to the setting of the clover seed, have had the scientific eye steadily fixed upon them. The pets of one family carried the disease to another, just as they carry other infectious germs, and there seems, so a report to the local government board insinuates, good reason for believing that in some instances it may have been conveyed from horses, sheep, and even from fowls to human beings. The diphtheritic germs are so vital that they are known to have communicated the disease after lying inert for four years.

THE new Simplon tunnel from Brieg, in Switzerland, to Isella, in Italy, will be 12½ miles long.

The Loudest Noise Ever Heard.

No thunder from the skies was ever accompanied with a roar of such vehemence as that which issued from the throat of the great volcano in Krakatoa, an islet lying in the Straits of Sunda, between Sumatra and Java, at ten o'clock on Monday morning, August 27, 1883. As that dreadful Sunday night wore on, the noises increased in intensity and frequency. The explosions succeeded each other so rapidly that a continuous roar seemed to issue from the island. The critical moment was now approaching, and the outbreak was preparing for a majestic culmination. The people of Batavia did not sleep that night. Their windows quivered with the thunders from Krakatoa, which resounded like the discharge of artillery in their streets. Finally, at ten o'clock on Monday morning, a stupendous convulsion took place which far transcended any of the shocks which had preceded it. This supreme effort it was which raised the mightiest noise ever heard on this globe.

Batavia is 94 miles distant from Krakatoa. At Carimon, Java, 355 miles away, reports were heard on that Sunday morning which led to the belief that there must be some vessel in the distance which was discharging its guns as signals of distress. The authorities sent out boats to make a search; they presently returned, as no ship could be found in want of succor. The reports were sounds which had come all the way from Krakatoa. At Macassar, in Celebes, loud explosions attracted the notice of everybody. Two steamers were hastily sent out to find what was the matter. The sounds had traveled from the Straits of Sunda, a distance of 969 miles. But mere hundreds of miles will not suffice to illustrate the extraordinary distance to which the greatest noise that ever was heard was able to penetrate. The figures have to be expressed in thousands. This seems almost incredible, but it is certainly true. In the Victoria Plains, in West Australia, the shepherds were startled by noises like heavy cannonading. It was some time afterward before they learned that their tranquillity had been disturbed by the grand events then proceeding at Krakatoa, 1,700 miles away.—*Sir Robert S. Ball, in the Youth's Companion.*

[It must have taken over two hours for the sound to travel that distance.—ED. S. A.]

UNITED STATES LARGE CALIBER MORTARS.

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A Scientific Expedition Lost.

The whaler Aurora, which recently arrived at Dundee, brings information of the loss of an Arctic exploring party. In June, 1892, two Swedish gentlemen named Bjorling and Kalstennius chartered a small schooner named the Ripple, at St. John's, Newfoundland, and, along with a crew of three men belonging to St. John's, set out to make scientific explorations of the fauna and flora of Greenland on the shores of Davis Strait. The west coast of Greenland was reached in safety, and the party was heard of last at the Danish settlement on the west coast in the summer of 1892. Since then all trace of the party has been lost. The Dundee whalers were requested by the Swedish consul before leaving for this season's fishing to keep a look out in Baffin Bay and Davis Strait, and make any inquiries as to where any trace of the missing party could be found. These instructions were attended to by the masters of the Dundee fleet, and while Captain Mackay, of the Aurora, was prosecuting early whale fishing in Baffin Bay he noticed a wrecked schooner on Carey Island, in the middle of the bay. A boat's crew was sent ashore, when it was found that the schooner was the Ripple, in which the exploring party set out. No boats were on board nor were there any provisions, and everything seemed to indicate that the vessel had been abandoned. She was fast in the ice. Examination of the vicinity was made by the crew from the Aurora, with the result that in a cairn of stones the dead body of a man, believed to be one of the explorers, was found. Close by was another cairn, which contained manuscripts written in English. One gave instructions that the manuscripts should be forwarded to the nearest Swedish consul. The contents of the manuscripts have not been fully ascertained, but it is believed they indicated that the exploring party were endeavoring to make for the mainland, about 200 miles distant, and that they perished in the attempt.

To Connect the Lakes with the Mississippi.

The recent tour of inspection down the Illinois River by several members of the Chicago Drainage Canal Commission resulted in a fresh impetus to the project of converting that stream into a great navigable waterway, connecting the lakes with the Mississippi. The members of the commission descended the stream in a steamer, met the inhabitants, business men and officials of the several cities and towns along the route, explained to them the nature of the great work undertaken, removed objection to the enterprise that had been fostered by prejudiced statements and misrepresentation, and thus enlisted popular friendship for the successful carrying forward of the work. The commissioners saw enough to convince them that, in an engineering sense, the scheme is an eminently feasible one, provided that the co-operation of national and State authorities can be enlisted in its prosecution. There is now little doubt but that such co-operation will be secured. The pushing forward of the Hennepin canal project, by government appropriation, and the contemplated expenditure of $6,000,000 for that work, shows that the purpose eventually is to perfect a navigable system between the lakes and the Mississippi that shall bring into connection with eastward water transit both the upper and lower reaches of the great stream, by way of the Illinois River and the drainage canal. Hitherto the Illinois has been rendered navigable by a succession of dams and locks, but this has proved ineffective, for the reason that the dams arrest the flow of water and cause the silt to collect above them and thus fill up the bed of the stream. When the drainage canal shall have been completed there will be a powerful flow of lake water through the river into the Mississippi. In order to make way for this, the dams must be removed. There will be a sufficient volume of water to sweep onward the silt and maintain a channel 14 feet in depth, it is claimed by competent engineers. Thus will be opened a navigable connection between Lake Michigan and the Father of Waters that will result in Western transportation changes of undoubtedly important possibilities. —*N. W. Lumberman.*

Smoke Prevention in Massachusetts.

The last Legislature of Massachusetts passed a law regulating the smoke nuisance in the large cities. This law provides that in cities of over 300,000 inhabitants, after July 1 of the present year, no person should "use bituminous coal for the purpose of making steam in boilers in any building, unless the furnace in which said coal is burned is so built or equipped that at least 75 per cent of the smoke is consumed or otherwise prevented from entering the atmosphere." The penalty was fixed at not less than $10 nor more than $100 for each week during which the violation of the law should continue.

It is to be hoped that other States will enact similar laws. It is an easy matter to prevent the smoking of furnace fires, and there is also economy in burning the smoke, which, as everybody knows, is composed of fine coal, which is allowed to escape before it has been properly acted upon by the oxygen of the air.

Cultivation of the Chocolate Tree.

Mr. J. H. Hart, the superintendent of the Royal Botanic Gardens, Trinidad, has recently been successful in transporting to Nicaragua a selection of the best varieties of Trinidad "cacao." Cacao seed soon loses its vitality, and can only be safely transported long distances by placing it in a suitable position to germinate and grow on the voyage. On April 25 of this year, Mr. Hart left Trinidad with a number of specially prepared cases containing plants, and seeds planted on the day of departure. The boxes in which the seeds were sown had not glass roofs, but were strongly latticed and covered with a movable sailcloth cover which could be easily and rapidly fastened or unfastened, to give light, or to protect from wind, rain and sun. A frame covered with wire netting was fastened inside each case, so as to press upon the surface of the soil, to prevent it shifting and causing the seeds to be disturbed. The seeds germinated ten days after planting, and on June 10 Mr. Hart reached his destination with more than 26,000 healthy plants, which were successfully put out in nurseries. A number of cacao seeds were sown at Nicaragua to develop during the return voyage, and, upon arriving at Trinidad, good healthy plants were obtained from ninety-eight per cent of the seeds planted. These plants included two species entirely new to Trinidad, and their introduction may eventually prove of great benefit to the colony.

The Mammoth in Alaska.

At a recent meeting of the Geological Society, London, reported in *Nature*, a paper was read consisting of notes on the occurrence of mammoth remains in the Yukon district of Canada and in Alaska, by Dr. George M. Dawson, C.M.G., F.R.S. In this paper various recorded occurrences of mammoth remains were noted and discussed. The remains are abundant in, if not strictly confined to, the limits of a great unglaciated area in the northwestern part of the North American continent, while within the area which was covered by the great ice mass which the author has described as the Cordilleran glacier, remains of the mammoth are either entirely wanting or are very scarce. At the time of the existence of the mammoth the North American and Asiatic land was continuous, for an elevation of the land sufficient to enable the mammoth to reach those islands of the Bering Sea where these bones have been found would result in the obliteration of Bering Straits. The bones occur, along the northern coast of Alaska, in a layer of clay resting on the somewhat impure "ground ice formation" which gives indications of stratification, and above the clay is a peaty layer.

The author considered this "ground ice" was formed as a deposit when more continental conditions prevailed, by snow fall on a region without the slopes necessary to produce moving glaciers. The mammoth may be supposed to have passed between Asia and America at this time. At a later date, when Bering Straits were opened and the perennial accumulation of snow ceased on the lowlands, the clay was probably carried down from the highlands and deposited during the overflow of rivers. Over this land the mammoth roamed, and wherever local areas of decay of ice arose, bogs would be produced which served as veritable sink traps. The author considered it probable that the accumulation of "ground ice" was coincident with the second (and latest) epoch of maximum glaciation, which was followed by an important subsidence in British Columbia. In the discussion of the paper, Sir Henry Howorth remarked upon the long and careful survey of Northwest America which has been made by the author, and upon the value of the conclusions which he has come to; first, in regard to the absence of ancient glaciation in Alaska and its borders; secondly, in regard to the existence of a great glacier in the Cordilleras, whose products are quite independent of and have nothing to do with the Laurentian drift; and thirdly, in regard to the distribution of the mammoth.

It was a new fact to him, and one of great importance, that mammoth remains had occurred in Unalaska and the Pribylov Islands in Bering Straits, proving that in the mammoth age there was a land bridge here, as many inquirers had argued. It would be very interesting to have the western frontier defined where the mammoth remains cease to be found. It would be very interesting to know how far south on the west of the Cordilleras the true mammoth, as distinguished from *Elephas Columbi*, has occurred. Regarding one conclusion of Dr. Dawson's, Sir Henry could not agree with him, namely, about the age of the strata of ice sometimes found under the mammoth beds in Alaska, as they have been found in Siberia. The speaker was of opinion that this ice had accumulated since the beds were laid down, and was not there when the mammoth roamed about in the forests where he and his companions lived.

Humus and soil cannot accumulate upon ice except as a moraine, and there are no traces of moraines or of great surface glaciation in Alaska and Siberia. Nor could either the flora or fauna of the mammoth age have survived conditions consistent with the accumulation of these beds of ice almost immediately below the surface, or consistent with their presence there. The speaker considered that these beds were due to the filtration of water in the summer down to the point where there is a stratum of frozen soil, through which it cannot pass and where it consequently accumulates, freezes, raises the ground, and in the next season grows by the same process until a thick bed of ice has been formed. The evidence goes to show that the present is the coldest period known in recent geological times in Siberia and Alaska, and that the period of the mammoth and its companions was followed and not preceded by an Arctic climate where its remains occur. Dr. H. Woodward remarked that the most interesting point in Dr. Dawson's paper was the mention of the remains of mammoths on the Aleutian Islands, proving that this was the old high road for this and other mammals from Asia into North America in Pleistocene times.

The Aluminum Flashlight.

In a communication to the London and Provincial Photographic Association, T. Bolas says: Aluminum has a much higher kindling point than magnesium, and, consequently, when aluminum filings are blown or dusted through an ordinary flame, they do not ignite, as they are not in the flame sufficiently long to become heated through. Again, aluminum, if heated in a crucible to a white heat, scarcely oxidizes, as the metal does not boil at this temperature, and a very thin film of oxide protects the surface. Magnesium would boil and blaze in a white hot crucible, as the vapor would burn.

If, however, we take the fine powder of aluminum, now so largely sold as a "silver" bronze, and blow or dust this through a flame, it becomes heated to the igniting point, and, weight for weight, yields a more powerful light than magnesium.

The commercial aluminum bronze powders contain, however, a trace of greasy material, which prevents the grains readily separating, and, if the powder contaminated with grease is blown through a flame, or used in an ordinary flash lamp, it tends to blow through in clots, and a large proportion escapes combustion.

This grease may be driven off or destroyed by heating the bronze powder to about the melting point of zinc; and, for operating on a small scale, it is sufficient to heat it in a test tube over a spirit lamp. The powder which I bring before you to-night has been thus heated, and it is readily blown about by the slightest breath. It ignites readily, and burns completely when used in an ordinary flash lamp; indeed, it burns more completely than does magnesium dust, as it is impracticable to use magnesium in an extremely fine state of division, owing to its tendency to oxidize spontaneously. Aluminum, on the other hand, can be stored in a minutely fine state of division without fear of deterioration by oxidation.

One incidental advantage of aluminum over magnesium is the non-irritating character of the fumes of oxide; magnesia, on the other hand, being an irritating alkaline earth.

New Use of Oxygen.

If there is one point more strongly impressed than any other upon the tyro in the use of oxygen and hydrogen, it is that he must be most careful to prevent any possible admixture of the two. The advice is most desirable, although it is well known that for explosion to take place the proportion of the mixed gases to each other must be within certain well-known limits. Outside those limits no explosion will take place. The knowledge of this fact underlies the novel application we refer to. At Huddersfield, Brin's Oxygen Company have erected oxygen plant for the purpose of supplying that gas to mix with the illuminating gas to be issued to the public. About six per cent is added just before it enters the station meter, and is then stored in special holders. The corporation gas is enriched to the extent of five and a half candle power by this addition, a fact which is most singular when it is remembered that atmospheric air is looked upon as a deleterious adulterant of ordinary coal gas.—*Br. Jour. of Photo.*

Vanadiferous Oil.

This oil, of slight density, varying between 1·15 and 1·20, is of a fatty appearance and contains 51·52 per cent of volatile matter. The percentage of hydrogen is much lower than that of the vanadiferous oil recently discovered in Argentina by Mr. Kyle, and carbon and nitrogen show a larger percentage. The most interesting feature of this oil is the presence, in the ashes, of a large proportion of vanadic acid in the shape of alkaline and metallic vanadates. It also occurs free in this oil, and may be extracted by washing with ammoniacal water. A quantitative analysis gave a percentage of 0·24 of vanadic acid in the oil and 38·5 per cent in the ashes. As the oil is abundant, some important applications of vanadium may be looked for if the properties of the metal are found to be commercially valuable.—*M. A. Mourlot.*

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The Porosity of Glass.

Some interesting experiments going to show that glass is more porous, under some conditions, than it has hitherto been considered, have been carried out by Messrs. E. Warburg and F. Tegetmeier. These experiments are described by Professor W. Chandler Roberts-Austen as demonstrating the possibility of producing eventually a degree of porosity in vitreous bodies which will admit of the passage of elements having comparatively small atomic volumes; while other elements having larger atomic volumes are strained off; thus occasioning a mechanical sifting of the elements. A receptacle was divided into two compartments by a sheet of glass, which could be several millimeters thick. Sodium amalgam was placed on one side and pure mercury on the other; the whole was then heated to the moderate temperature of 200° C, at which the glass becomes slightly conducting. The positive and negative wires from a Plante battery were then respectively placed in connection with the contents of the two compartments; and it was found at the end of 30 hours that a considerable quantity of sodium had passed into the mercury through the glass, which had nevertheless preserved its original weight and transparency.

A CARBONIC ACID MOTOR.

BY GUSTAVE MICHAUD, SC.D., COSTA RICA.

This little apparatus derives its power from self-compressed carbonic acid. I devised it to illustrate Pascal's principle as well as many other chemical and physical phenomena. It is easily made; some of my pupils constructed it in less than an hour with materials obtained from the apothecary. If made of the dimensions I give below, it will oscillate for three or four hours without being reloaded. Its various parts are as follows: Two 9-or 10 oz. bottles, B, with wide mouth. One glass tube, T, about 26 in. long and ¼ in. bore (cost about three cents). Two glass tubes, E, 6 in. long each; ¼ in. bore (cost about two cents). Two rubber stoppers, K, each with two holes (cost about fifteen cents each). If cork stoppers are used the expense is much reduced, but a set of round files (rat tails) or a cork borer will be necessary to bore holes in the cork. Two rubber tubes, I, about 4 in. long, ¼ in. diameter (cost about ten cents). One rubber tube, R, about 19 in. long, ⅛ in. diameter (cost about ten cents). A piece of wood, A, shaped in the form of a quadratic prism; size 1 × 1 × 2 in. Two pieces of sheet iron, S; size 1½ × 2 in. Two pieces of marble the size of a nut, each wrapped in a piece of linen.

To make the apparatus, take the glass tube, T, introduce each of its extremities through the holes of the two rubber stoppers, K, place the rubber tubes, I, on each of the ends of the tube, T; take a needle with common thread and sew the piece of marble wrapped in its linen to the free end of the rubber tubes, I. Take the piece of wood, A, nail on each side of it a piece of sheet iron, S. Out of the central part of the piece, A, saw a cleft perpendicular to the metallic sheets, S. Press the center of the tube, T, in this cleft, and keep it in place by means of two pieces of wood screwed on the top of the piece, A.

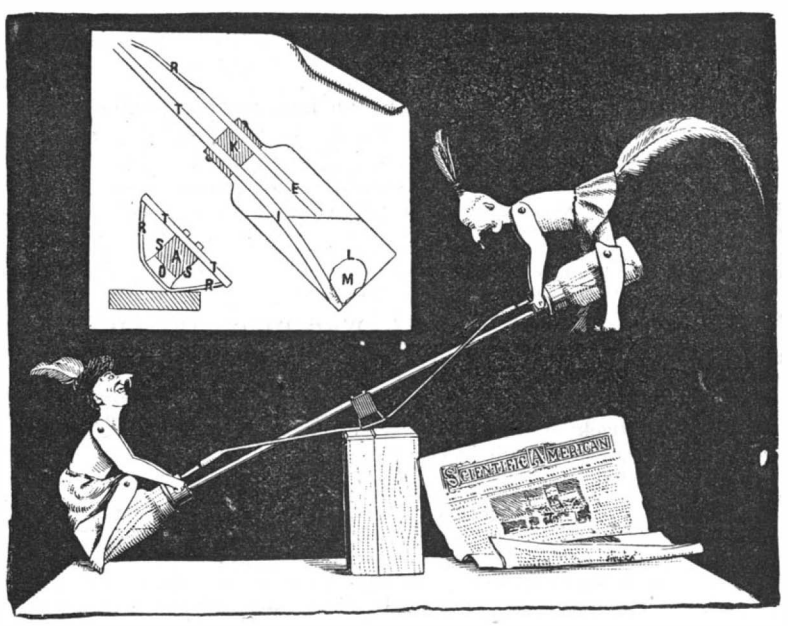
Pass the tubes, E E, through the holes left empty in the stoppers, so that the length of the part to be contained in the bottle be equal to half of the height of the bottle. Connect the tubes, E E, by means of the rubber tube, R. After putting it in place, cut a small hole in its central part, O. Last, stop one bottle with either of the two stoppers.

To set the apparatus in motion, fill half of the unstoppered bottle with a mixture of one volume of hydrochloric acid with one of water. Stop it, keeping meanwhile the whole apparatus in a vertical position, and place it at once on a box or any other stand, five to eight inches high.

The occlusion of the rubber tube, R, by the pressure of one of the pieces of sheet iron, S, will prevent the escaping of the carbonic acid, and the pressure of this gas will drive the liquid from the lower to the upper bottle through the glass tube, T. Meanwhile, the gas contained in the upper bottle will escape through the hole, O, made in the center of the rubber tube, R. If the center of gravity of the apparatus is not much above its oscillating axis, the upper bottle will fall after receiving little more than half of the liquid contained in the lower one. Then the change that takes place in the occlusion of the rubber tube, R, by the pieces, S S, will cause a repetition of the same phenomena in opposite direction.

If you wish the apparatus to cease its motion for a while, without waste of chemicals, place any heavy body on the lower bottle, which will then completely empty itself into the upper bottle and all chemical action will cease, as the marble is never in contact with the liquid in the upper bottle.

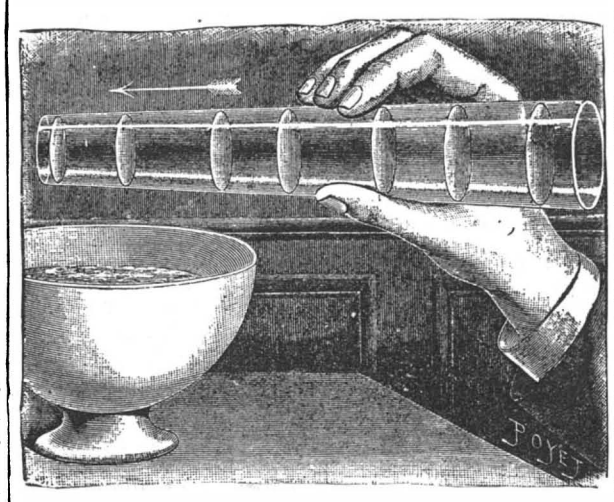
When made of the dimensions which we give above, its working expenses will be about one-eighth of a cent per hour, cost of the hydrochloric acid consumed.



A CARBONIC ACID MOTOR.

EXPERIMENT ON THE TENSION OF LIQUID FILMS.

Take a lamp chimney of conical form, that is to say, wider at the bottom than at the top, wet the interior with soapsuds, and then drain in order to get rid of the liquid in excess. Then, holding the chimney upright, dip the wide end in the soapsuds. Upon removing it, it will be found that, toward this extremity, a film of soapsuds has formed in the interior. Now place the chimney horizontally, and the liquid film will be observed to set itself in motion, and in a moment reach the narrow extremity of the glass. This phenomenon is due to the elastic tension of the film, which might be compared to a distended membrane



EXPERIMENT ON THE TENSION OF LIQUID FILMS.

of rubber, which contracts as soon as the traction upon its edges diminishes. Now here the traction becomes feebler and feebler in proportion as the diameter of the glass diminishes. Instead of a single film, a second may be formed as soon as the first has moved a slight distance from the wide end of the chimney. and then, successively as many films as may be desired. All will be observed to set themselves in motion and travel toward the narrow end, as if they were chasing one another.—*L'Illustration.*

Blackening of Incandescent Lamp Bulbs.

I have repeatedly noticed (writes Mr. W. Stuart-Smith in the *Electrical World*) discussions as to the cause of blackening of incandescent lamp bulbs. The latest theory seems to come from France, and is to the effect that residual oxygen in the bulb, together with that which was occluded in the filament, attacks the carbon and forms carbonic oxide, which undergoes dissociation by coming in contact with the comparatively cold glass, depositing the carbon and leaving the oxygen free for a repetition of the process. It has been some years since I have paid attention to chemical matters, but, unless I am mistaken, cooling as above would *not* cause dissociation, and the above explanation cannot be the correct one. It seems to me that a portion of the action at least *must* be due to the following cause: It is well known that all substances in the solid or liquid form give off vapor, in fact, are surrounded by an atmosphere of their own vapor.

If the substance is confined in an airtight space the vapor density is definite for every substance and for every temperature, but varies greatly with the temperature, being much greater for high temperatures. For a given substance and a given temperature the vapor density will be the same, no matter what other gases may be present; but if other gases are present in considerable quantities, considerably more time will be required for the density to reach its maximum value. In a vacuum, on the contrary, the action is comparatively rapid. Carbon, when cold, is a very stable substance, and its vapor density very low; but at the high temperature of the white-hot filament vaporization must be comparatively rapid and the vapor density relatively great. As the hot vapor comes in contact with the cooler glass it will deposit, and thus vaporization, instead of stopping, as would be the case if the glass were the same temperature as the filament, continues while the lamp is burning. When the lamp is extinguished the vapor in the globe must deposit on the glass until the definite density of the vapor of the cold carbon is attained. The more rapid blackening when the lamp is new may be due in part to the better condensing action of the clean glass, and it may be due in a greater part to the fact that some portions of the filament are more easily volatilized than others, and the action consequently more rapid while these are being thrown off.

A New Fertilizer.

In tallow melting establishments—and there are a score of them in the city of New York—a large amount of refuse, so-called "tank water," is thrown away. It contains a valuable element, gelatine. A patent has lately been granted to Michael A. Golseieff, of this city, for a method of utilizing the above waste product. It consists in partially evaporating the tank water and then combining it with quicklime in the proportion of one and one-half parts of lime to each part of water remaining in the refuse after the evaporation. The mixture is then allowed to expand and dry, when it is reduced to a powdered state, and is useful as a fertilizer, containing, as the patentee claims, from seven to twelve per cent of ammonia and from forty to sixty per cent of lime. If the new process should be found practicable for adoption by the various tallow melting manufactories, then a waste refuse of to-day will be made useful, and what is now a nuisance to public health will be abated.

Colors of Ancient Egypt.

The pigments used by the ancient Egyptians 4,000 to 6,000 years ago were few and almost all represented what have been called primary colors. Red seems to have been most used in the outside decoration of buildings. Giving results of an investigation of Mr. Flinders Petrie's specimens, Mr. W. J. Russell states that the red pigment was a ferric oxide, an oolitic hematite, with a little clay, the proportion of ferric oxide varying from 70 to 80 per cent. It was a natural pigment, unaffected by sunlight, heat or acids. Another color was a dull yellow, and this also consisted of oxide of iron, combined with alumina, lime and some water—being essentially a kind of colored clay. A reproduction of the mixture was fadeless in light, but was changed by heat. An orange about 4,000 B. C., by one of the first pyramid builders, was a mixture of the red and yellow. The maker mixed his colors with gum. A very bright yellow contained arsenic, and was in fact orpiment, which is now produced artificially. Beaten gold was the mineral called chrysolite; but in later times a kind of glass or frit colored with oxide of copper was used, and gave various shades. It could be rubbed down in a mortar, and was probably applied with gum. The white pigment used was sulphate of lime, known also as gypsum and alabaster. A pale pink color contained 99 per cent of sulphate of lime, the rest being an organic compound believed to be madder.

Transportation of Liquid Air.

In connection with the forthcoming lectures at the Royal Institution on "Air, Gaseous and Liquid," it may be mentioned that Prof. Dewar has successfully conveyed a considerable quantity of liquid air from London to Cambridge. The liquid air was carried in one of the double glass, vacuum jacketed flasks, the space between the inner and outer flask containing nothing but extremely attenuated mercurial vapor, together with a little liquid mercury. On pouring liquid air into the inner flask its outer surface is rapidly covered with a mercurial film of extreme thinness, forming a reflecting surface highly impervious to radiant heat. As soon as this is formed the whole apparatus is packed in solid carbonic acid, which at once freezes the liquid mercury, arrests the deposit upon the mirror, reduces the mercurial vapor to an infinitesimal quantity, forms an almost perfect vacuum, and supplies an envelope 80 degrees below zero. Thus protected, the liquid air reached Cambridge. The protective power of the high vacuum and the mercurial mirror will be better appreciated if it be borne in mind that the difference of temperature between liquid air and solid carbonic acid is the same as between ice and boiling water.

THREE routes for a cable line to the Sandwich Islands have been surveyed, and each is said to be practicable.

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RECENTLY PATENTED INVENTIONS.

Electrical.

ELECTRO-MAGNETIC RECIPROCATING MOTOR.—Richard Threlfall, Bayswater Road, Darlinghurst, Sydney, New South Wales. A bi-polar electro-magnet is, according to this improvement, provided with both magnetizing and demagnetizing coils on each polar extremity, and a rotary commutator is provided with four sets of contacts, two for each end of the magnet, for controlling the current passing through the magnetizing and demagnetizing coils, thereby using the current to produce a direct reciprocating motion, instead of first a rotary, to be afterward changed to reciprocating by cranks or other mechanism. The combined mechanical and electrical efficiency is also designed to be greater, the parts fewer, the friction less, an the construction more simple than apparatus at present employed.

Railway Appliances.

FREIGHT CAR FITTING.—Archie J. Sneed, Jr., Canton, Miss. This is an adjustable attachment for supporting boxes, crates, etc., containing fruit and other merchandise, and consists of rails adapted to be fastened on the car floor, standards being held adjustably on the rails, and cross bars sliding in the standards. The device is very simple and readily removable at any time when it is desired to use the car for general purposes.

REFRIGERATION AND STORAGE.—Charles S. Hardy, San Diego, Cal. This invention applies to devices for use in railway cars, steamboats, ships, warehouses, dwellings, etc., and especially for places where it is desired at times to use the room for storage without refrigeration. The ice box, refrigerating chamber, and air flues are so arranged that the air circulation will be uniform, the foul gases being absorbed and carried away by the water flowing from the melting ice. The ice boxes are adapted to be conveniently cleaned, and may be folded at the top of the storage chamber when refrigeration is not desired.

REFRIGERATOR CAR.—Two further patents have been granted the same inventor, embracing additional improvements in line with the above invention, one of them providing better means for hinging and supporting the folding floor or bottom of the ice box, and fastening it to the swinging side sections when in normal or folded position, the bottom and one side of the box being adapted to fold against the end wall and roof of the car. The other invention embodies an improvement consisting in connecting the floor and one of the swinging side sections of the ice box by such means and in such manner that, while permanently attached to each other, they are yet flexibly connected so as to be adapted to fold and unfold, and one to support the other in such operation.

REFRIGERATOR CAR.—Perd A. Barker and Fred A. Reynolds, Los Angeles, Cal. This invention provides a special form of construction adjustable to form an ice box, or adapted to be folded to leave the interior of the car unobstructed. It consists of removable partitions and a removable ice rack hinged to the bottom of one of the partitions and arranged to be folded between the partition and the side of the car. A door is provided in each partition to allow access from the interior of the car to the ice box, when the latter is in use, and the necessary drip pans are built with the car and remain in position when the side walls of the ice box are folded out of the way.

GUARD RAIL.—Lewis J. Baker, Marietta, Minn. This a device for use on bridges, curves, trestles, etc., to keep the wheels on the rails in case of the spreading of the track or the breaking of a rail. It consists of a rail provided with a guard member inclined inwardly toward the inner face of the head of the rail, and formed with a bearing face at its upper end, adapted to be engaged by the flange of the wheel as it cants inward, the peculiar arrangement and connection of the guard rail with the main rail being such that the guard rail will not cant or be bent over by the lateral strain of the inner face or flange of the wheels.

HAND WHEEL FOR CAR BRAKES.—Frank. J. Pfenigar, Bay City, Mich. The attachment of a hand lever to the wheel in such a way as to permit the use of the wheel in the ordinary manner at all times, and also allow it to be turned by the lever when desired, is provided for by this improvement. The brake wheel has an annular toothed ring inside the rim on its upper face, there being a finger space between the ring and rim, and a lever journaled on the wheel shaft has a hinged member with a dog or claw to engage the toothed ring, the hinged member being constructed to swing back from engagement with the rim.

Mechanical.

BALL BEARING.—Olaus B. Jacobs, Fremont, Washington. In a fixed box a series of rings oppositely beveled form V-shaped annular recesses holding balls which project beyond the rings and space them from the box, the rings being adjustable and their movement pressing the balls outward into direct contact with the box, This bearing, introduced between the periphery of the shaft or axle and the box, is designed to reduce friction and wear to a minimum, and the wear is readily taken up between the rings, balls, and box.

ROD HEADING MACHINE.—Daniel M. Redmond, Philadelphia, Pa. This is a machine for rapidly and securely fastening heads or tips on the outer ends of rods used to make key rings and other articles. It comprises a reciprocating die with a central recess and branch recesses leading therefrom, a second die sliding toward and from the reciprocating die and having recesses registering with its recesses, a rod carrying the second die, and a cam for moving the rod upward to bring the rod and head held on the second die in contact with the reciprocating die. When the two dies are moved toward each other, the sides of the head or tip are compressed to fasten it onto the rod.

MAKING EYES ON UMBRELLA RIBS.—This is another invention of the same inventor, providing a machine for conveniently and rapidly forming the eyes for umbrella ribs and securing the eyes in place on the ribs. It comprises a revoluble die for bending the wire to form the eye, a stationary female die and a reciprocating male die or punch for pressing the rib end onto the eye shank to fasten the eye in place.

Agricultural.

POTATO DIGGER.—Daniel J. McDougall, Dewdney, Canada. In this machine the potatoes are gathered by a shovel, and a dirt separator delivers the potatoes to a carrying drum, by which they are delivered upon a sorting screen or sieve, the shovel, separator and drum being adjustable, and the mechanism being driven from the supporting wheels as the machine is drawn along. Beneath the sorting screen or sieve is a box to receive the potatoes and a platform for a receptacle for potatoes too large to pass through the screen.

RAKE AND LOADER.—Jesse S. Byers, Knoxville, Ill. This is a hay loading apparatus which gathers the hay in being moved over a field, raises it by means of elevator arms operated through gearing connections with one of the drive wheels, to be delivered in proper position on the wagon, where an operator stands to guide the arms in placing the hay as the load increases in height. The hay is prevented from being blown off the machine while it is being passed up to the wagon.

WIRE BAND CUTTER.—Joseph Sindelar, Ipswich, South Dakota. This is a simple device to be worn on the hand for cutting the wire bands of grain bundles before the grain is fed to a thrashing machine. It comprises a strap, with hole to receive the thumb, to be buckled around the hand and carrying across the palm a knife or blade, which enables the operator to feed the machine and at the same time sever the band without danger of cutting himself.

Miscellaneous.

SEWING MACHINE FEED.—Victor Leconte, père, Paris, France. To facilitate the commencement of work in the manufacture of heavy goods is the especial design of this improvement, which comprises the employment of a novel form of feed claw, operated by cams in unison with the feed wheel. The invention also comprises an improvement in the feed pressure, which, in combination with the feed claw, prevents slack sewing, a brake arrangement being also employed to prevent the too free movement of the feed wheel and enable the machine to be readily driven by hand.

FIREARM.—George H. Garrison, Sumas City, Washington. In combination with an ejector and a spring-controlled hammer, on which operates a cocking slide, is an ejector lever whose upper end bears against the ejector, a link or hook being pivotally connected with the lever, while a cocking tumbler fulcrumed upon a fixed support is pivotally connected with the cocking slide and the cocking link. The improvement is especially designed for double-barreled breech-loading guns, and provides for the automatic ejection of the shells and the simultaneous and automatic cocking of the hammers when the barrels are brought in position for the shells to be ejected.

CLOCK WINDING MECHANISM.—Andrew J. Hopewell, Edinburg, Va. This mechanism comprises a wind wheel operating an air-forcing device, a pneumatic wheel having buckets or blades and a pipe leading from the air-forcing device and discharging into or against the buckets or blades, while connected therewith is a mechanism for operating the winding shaft of the clock from the pneumatic wheel. The apparatus may be arranged for conveniently and automatically winding spring or weight actuated clocks.

WINDOW.—Gustav Thiel, Medford, Wis. This improvement consists of a sash frame carrying the window sashes and mounted to turn in the window frame, whereby the window can be readily reversed to facilitate cleaning the panes and sashes on the inside and outside. The window frame has central pivots on which the sash frame is hung, there being boards hinged to the top, bottom and sides of the window frame on the inside to engage the sash frame and lock the latter in place.

PREVENTING MOISTURE ON WINDOWS.—Benjamin D. Ayars, Jr., Chester, Pa. This inventor has provided an improvement designed to cause a current of cold air to move down the inner surface of the window glass, preventing the contact therewith of the moist warm air of the room. A narrow opening of the width of the window admits the outside air at the top, the air being directed downward by an adjustable deflector, while a similar opening at the bottom creates a vertical draught, the bottom opening being preferably connected with a pipe leading to the draught flue of a furnace.

SHIP'S HULL.—Patrick O'Brien, St. John's, Newfoundland. The bottom of this vessel is convex from the stem to the stern and concave from the keel to a sharp-edged bilge, while from the bilge to the top of the hull the sides prevent an outer convex surface at the stern, the remaining portions being outwardly flared. The hull is designed to minimize drifting to leeward, and to facilitate the attainment of the highest speed, while affording a stable construction.

PHOTOGRAPHIC RETOUCHER.—James R. Dake, Medford, Wis. This device has a tubular body, with vibratory pencil holder, and a circular case within which is a pneumatic wheel with its axle bearing a cam and crossing the upper end of the holder, the shaft and the spring keeping the holder in constant vibration, whereby the pencil will produce such a stroke as is made by hand, but doing the work much more expeditiously. The device is very simple and inexpensive, and is capable of softening a line, stopping a pinhole, raising a shadow, sharpening an eye. or raising a light in the eye or in the drapery, and similar work such as ordinarily done by hand.

COLORING METAL LEAVES.—Josef Rosenthal, Furth, Germany. The producing of a uniform, homogeneous color on these leaves, instead of variegated colors, as hitherto, is provided for by this invention. The process consists in subjecting the leaves to a uniformly distributed heat to form an even layer of oxide, the leaves being piled with interposed plates of paper, glass, mica, etc., with appropriate coloring or other substances applied, and the packs being placed in a closed space through which a current of hot air is circulated to create an even temperature, the air being heated to any required degree.

GRADING POWDERED MATERIALS.—William W. Gillespie, Stamford, Conn. This apparatus comprises a tank with a rotary agitator, into the lower portion of which a supply pipe discharges, a valved outlet pipe leading from the bottom of the tank and discharging into a wet mill or grinder, while there is a flushing mechanism for the lower end of the tank. The apparatus is to facilitate the obtaining of fine powders, in the separation of which it has been hitherto customary to float the powdered material in a series of tanks in a nearly horizontal direction.

TRAP GUN.—Milan S. Barker, Eugene, Oregon. A device to automatically shoot and kill animals trapped by it has been contrived by this inventor. It is of simple and durable construction, and has a barrel open at both ends, but with a cap-like breech block inclosing the breech, while being removable therefrom and carrying the firing mechanism. A bait holder is connected to the trigger, and a shell-extracting mechanism carried by the block locks the latter against accidental displacement, the shell being extracted by the act of removing the block.

CONVERTIBLE CHAIR.—Joel H. Woodman, Hoboken, N. J. This is a combination article of furniture to serve as a settee, screen and table, the construction being durable and ornamental. The portion of the article which serves as a screen when used as a settee, is folded to be utilized as a table top when it is to be used as a table. The table portion may also be fitted for use as a billiard table. Shelves are also designed to be hinged at the back of the settee, chains or cords connecting the shelves with each other and with the screen.

GATE.—Levi W. Youngs, Sackett's Harbor, N. Y. A gate which may be set up conveniently in a short time upon any kind of land, and which may be readily carried from place to place as desired, has been provided by this inventor. It is neat in appearance, suitable for farmyard or residence, and may be slid open to permit the passage of stock or swung entirely open to give room for the passage of vehicles, etc.

BRAKE FOR CHILDREN'S CARRIAGES.—Frederick O. Boës, New York City. The brake bar, adapted for engagement with the wheels, has a pivotal connection, according to this improvement, with the handle bars of the carriage, and a spring is connected with the brake bar and a fixed support on the carriage, the arrangement being such that when the brake is in engagement with the wheels the carriage cannot be moved, and may be safely left upon an incline. The improvement is readily applicable to any style of child's carriage.

MERRY-GO-ROUND.—John S. Sprague, Tottenville, N. Y. This is an improvement in that class of constructions in which radial inclined planes are hinged to a central portion of a revolving frame and supported at their outer free ends by wheels that travel on a serpentine or wave track, so as to rise and fall regularly as they sweep around the circle.

SURGICAL INSTRUMENT.—Alonzo C. Kellogg, Portage, Wis. This instrument has pivoted prongs adapted to close at their free ends to receive an elastic band, a button being connected with the prongs to open and close them simultaneously.

FRAME FOR POCKET BOOKS, ETC.—Samuel Rosenzweig, New York City. This invention consists of hinged frame members held closed by a lock, there being a fixed pin on the frame and a spring-pressed sleeve over the pin normally inclosing its point. It is also designed for use on satchels, bags, and similar articles, the locking device of the frame being disguised.

ALARM BELL.—William H Polleys, Melrose, Wis. This improvement provides a novel means of attaching the bell and connecting it to a door knob so that an alarm will be sounded when the knob is turned or an attempt made to open the door. The connection may also be locked in such position that the knob cannot be turned, thereby providing a lock for the door, or an alarm may be rung either from the outer or inner side of the door when the connection is in locked condition.

WHIP RACK.—Alfred H. Phinney, Williams, Iowa. A large number of whips may be held in a comparatively small rack made according to this improvement, the whips being displayed to advantage and easily placed in the rack or removed from it. The device is adapted to stand upon the floor or be suspended from the ceiling, and is of simple and inexpensive construction.

SLEIGH RUNNER.—William DuBois, Stevensville, N. Y. This runner is made in two parts, one part forming the shoe and the other part forming a frame or keeper for the shoe, the latter having a dovetail head fitting in a dovetail recess in the keeper, so that no bolts or rivets project downward in the shoe, which is solid from one end to the other. The runner can be readily fastened to the frame of a sleigh of any construction.

STILT.—Edward C. Emde, Tacoma, Washington. The stirrup of this device is of simple and inexpensive construction, readily adjustable by a boy at any desired point in the length of the stilt. Its construction is such that it will not move laterally when the foot is in the stirrup and the stilt is in use, but should the stilt walker fall, the stirrup will be free to move so that the foot will readily slip from it.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

AVERY'S PHONETIC ALPHABET. By Robert Stanton Avery. 12mo. Pp. 48. 20 cents.

Phonetic First Book. 12mo. Pp. 32. 15 cents.

Anti-Phonetic First Book. 12mo. Pp. 32. 15 cents.

Pnonetic Primer. 12mo. Pp. 80. 35 cents. All published by the author, 320 A Street Southeast, Washington, D. C.

These four little books are intended to aid in the introduction of fonetic spelling, as the author terms it, as a branch of study in schools for the purpose of extending systematic spelling as we pronounce. The author recommends the books for use by those studying phonography in connection with Pitman's Phonography. The type of the new system is very homely, somewhat resembling Russian.

INORGANIC CHEMISTRY FOR BEGINNERS. By Sir Henry Roscoe, assisted by Joseph Lunt. With one hundred and eight illustrations in the text. New York and London: Macmillan & Co. 1893. All rights reserved. Pp. ix, 245. Price 75 cents.

We are glad to see, on general principles, a chemistry devoted to inorganic work. This is a book for those beginning the study of the science, and is devoted to the elementary principles of chemistry. It makes no pretense to be a complete work, but is an introduction to that part of chemistry usually first studied by students. Thus, we find that metals are entirely omitted from it, the laws of the science being elucidated by the gaseous elements and by carbon and sulphur, the elements usually first treated of in the regular works on chemistry in general.

UTILITY OF QUATERNIONS IN PHYSICS. By A McAulay. London and New York: Macmillan & Co. 1893. All rights reserved. Pp. xiv, 107. Price $1.60.

This publication is an essay sent in to compete for the Smith prize at Cambridge. The author, who is evidently an enthusiast on the subject, considers it an eminently useful branch of mathematics and devotes his preface largely to the lamentable fact that Cambridge University does not devote proper attention to applied quaternions.

SCIENTIFIC AMERICAN BUILDING EDITION.

DECEMBER, 1893.—(No. 98.)

TABLE OF CONTENTS.

1. Elegant plate in colors showing a colonial residence at Stamford, Conn., recently erected for C. Cooper Clark, Esq., at a cost of $9,500 complete. Floor plans and two perspective elevations. An excellent design. Mr. Augustus Howe, architect, New York.
2. Plate in colors showing the residence of Thomas C. Wordin, Esq., at Bridgeport, Conn. Two perspective views and floor plans. Cost $5,000 complete. A very attractive Queen Anne design. Mr. Henry A. Lambert, architect, Bridgeport, Conn.
3. A dwelling erected for Edward W. Alling, Esq., at New Haven, Conn. Perspective and interior view and floor plans. An excellent design. Cost $4,500 complete. Messrs. Stilson & Brown, architects. New Haven, Conn.
4. A very attractive residence recently erected for R. Burton, Esq., at Hartford, Conn., at a cost of $7,800 complete. Floor plans, perspective view, etc. Mr. Henry D. Hooker, architect, New York. An excellent design.
5. Engravings and floor plans of a suburban residence erected for H. McKay, Esq., at Boston, Mass., at cost of $2,400 complete. Mr. Austin W. Pease, architect, Boston, Mass. A very attractive design.
6. A dwelling recently erected for P. H. Lucas, Esq., at Chester Hill, Mt. Vernon, N. Y., at a cost of $7,000. Floor plans and perspective elevation, also an interior view. Mr. Louis H. Lucas, architect, Mt. Vernon, N. Y.
7. A cottage at Mystic, Conn., erected at a cost of $3,000 complete. Elevation and floor plans and an interior view. Mr. John S. Rathbone, architect, New London, Conn.
8. A dwelling recently completed at Stamford, Conn., at a cost of $3,500 complete. A picturesque design. Two perspective views and floor plans. Messrs. Munn & Co., architects, New York.
9. Miscellaneous Contents: The education of customers.—How to catch contracts.—Hints to readers.—The latest and best designs for houses.—Labor Day.—Tests of paving materials.—The World's Columbian Exposition, a general view.—The builders' friend.—A durable and ornamental roof, illustrated.—An improved woodworking machine, illustrated.—The Pasteur filter, illustrated.—The Rochester parlor heater and improved oil stove, illustrated.—A stovepipe radiator, illustrated.—An electric passenger elevator at the Exposition, illustrated.—Woodworking machinery at the Fair.—A new building material.—Torsion braided wire mattresses, pillows, cushions, etc., shown at the Exposition, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5559) F. B. H. asks for the specific gravity of graphite, as used in lead pencils and different pigments used in paints. A. We give some specific gravities: graphite, 1·9 to 2·3; zinc white, 5·6; white lead, 6·5; barytes, 4·5 to 4·75; red oxide of iron, 2·6 to 3·1; chrome yellow, 5·653; chrome red, 6·266. In works on paints specific gravities of other pigments may be found. In many cases it will be almost impossible to find reliable data. We recommend and can supply you with the following books relating especially to the subject you refer to: "The Painter's Encyclopedia," by Gardner. Price $1.50. Hurt's "Painter's Colors, Oils, and Varnishes." Price $3.50. Riffault's "Treatise on Colors for Painting." Price $7.50. Church's "Chemistry of Paints and Painting." Price $1.75 mailed.

(5560) A. B. asks: Is the life of a bichromate plunge battery dependent upon the amount of fluid in the cell, *i. e.*, will a cell holding one quart of fluid be longer lived than a cell holding only one pint of fluid, the carbon and zinc plates being the same size in both cases? A. The life for one charge is dependent on the fluid contents. A quart of solution properly used will give twice the quantity of energy that a pint of solution will afford. A large cell contents obviates the necessity for frequent recharging.

(5561) C. C. L. writes: Does exposure to light affect bichromate of ammonia? Does exposure to air weaken it, and what is the change? Is there a test for its purity and strength? Is its action on organic matter chemical or mechanical when exposed to light? What is the nature of the change? A. The salt is permanent in the air. In contact with organic matter when exposed to light chromium trioxide is produced, the action being one of chemical reduction. There is no test for its purity and strength except analysis.

(5562) P. K. asks: Is there any way to cut bottles so as not to crack them? A. File a notch on the side, rub the end of a red hot poker back and forth upon the surface of the glass until a crack is started, then with a hot poker lead the crack wherever you wish. It will follow the course of the hot iron. Cracking coal is preferable to the hot poker. It consists of a crayon of charcoal, saturated with a weak solution of nitrate of potash and dried. It burns to a point, and maintains a continuous red heat. If the potassium nitrate solution is too strong, the crayon will be more or less explosive.

(5563) D. & C. ask: Can an incadescent electric light current from a circuit of 110 volts potential be successfully used for electroplating? If so, how? If not, why? A. By using sufficient resistance it can be done. But as a very small quantity of the electric energy will be utilized in the plating, the resistance absorbing most of it, the process will be too uneconomical for use.

(5564) G. B. B. writes: Has the Leclanche battery to be filled with new solution before working, or will it work if the circuit has been left open for some time? If so, about how long will it take? A. New solution is not required unless the old has been exhausted by use. Standing on open circuit restores the strength of the battery if the solution is not used up.

(5565) E. M. asks: If a hen and a half lay an egg and a half in a day and a half, how many eggs will seven hens lay in seven days? A. One hen in a given time will lay half an egg less than a hen and a half. Therefore one hen will lay one egg in a day and a half, or two-thirds of an egg in a day. Seven hens in seven days will lay $7 \times 7 \times \frac{2}{3}$ eggs, or $\frac{98}{3} = 32\frac{2}{3}$ eggs.

(5566) W. A. P. says: We have a fire engine (steam) to which I wish to attach a heater from a coal stove, so as to keep water warm in boiler of engine for winter. Please let me know the best way to arrange heater in stove and how best to connect to boiler. A. The stove should be placed below the floor of the engine house, with a coil of 1 inch iron pipe just above the fire, so that when the engine boiler is disconnected, the pipe will not be overheated and throw out the water. Two or three turns of pipe inside the stove is sufficient. The pipe from each end of the coil may pass up through the floor with a 1 inch hose connecting with the blow-off cock from the bottom of the coil, and another hose from the pipe leading to the top of the coil, connected to cock inserted in the side of the boiler at any convenient place below the water line. A small tub can be placed nearby, partly filled with water, to drop the ends of the hose into when the engine is uncoupled for use, which will prevent the pipes in the stove becoming empty. By this arrangement the fire in the stove may be left burning while the engine is away. The same stove may be used for heating the engine house by placing a register over it, if under the floor, or by setting the stove in an open pit several feet below the floor.

(5567) P. P. asks: 1. How coal tar that is to be used for paint can be colored. A. Coal tar cannot be given bright or very light color by any mixture. Any of the dry paints, with a little turpentine, will mix with and lighten the color. Red oxide of iron paint will make a dark red and zinc white will make a dark gray. What published work should a person consult to become familiar with the analysis of feed water for steam boilers, to determine the amount of lime, magnesia, and other scale-forming salts contained therein? A. "Water Supply," by Nichols, is an excellent work for study on the purification of water for all purposes. $2.50 by mail.

(5568) T. R., A. H. College, Salt Lake City, asks the means of keeping in good order leather pistons, washers, etc., of our apparatus. On account of the dryness of our climate they quickly contract, to our great annoyance. A. Wet the leathers with glycerine. The brown or unbleached is preferred. It does not evaporate, but absorbs moisture and keeps the leathers soft and full.

(5569) J. P. writes: A bets the propelling power of a screw is obtained on the forward side of the blade. B bets it is got from the after side. A. The power of screw propeller is given principally from the after side of the blade by its pushing and projecting the water backward. A small portion of the power of propulsion is also derived from the sucking action of the front of the blade in drawing the water toward it.

(5570) C. & McC. ask for a receipt for making a paint or putty to fill the unevenness of castings like machinery manufacturers use to paint new machinery, such as planers, lathes, and engines. A. Plaster of Paris, gum tragacanth, and fine iron filings mixed in a putty with water make a hard cement for filling iron castings.

(5571) B. H. asks: 1. Can water contain more than 212° heat (and remain such) under pressure, as in a boiler, steam pressure say at 100 pounds or upward? A. There is no limit to the degree of heat that may be given to water within the limit of power to hold it. More than 1,000 pounds pressure per square inch, with a temperature of 546° Fah., has been in practice. Water in boilers under pressure is always at the temperature of the steam due to pressure. At 100 pounds it has a temperature of 338°. 2. Who invented the gimlet-pointed screw? A. The gimlet-pointed screw was first made by the American Screw Company in Providence, R. I., about forty years ago, under patents held by the company.

(5572) T. L. says: The process described in SCIENTIFIC AMERICAN SUPPLEMENT by Mr. F. Watts, F.I.C., analyst to government of Leeward Islands, for purifying water by ferric chloride, has been practiced in the United States at least five years, notably at St. Louis, upon Mississippi water.

(5573) E. S. D.—Carborundum was discovered by Mr. E. G. Acheson, of Pennsylvania, in 1890. It is equal to the diamond in hardness. It cannot be moulded, not being plastic. For excellent papers on the subject we refer you to our SUPPLEMENT, Nos. 863 and 929.

(5574) D. J. H. writes: I have a new house in a section where there is no city water or wells, and the only water obtainable is rain water, which I collect in a stone cellar, lined with lime and Portland cement. Will you please tell me through your paper the cheapest way in which I can rid the water of the lime and reddish color it now has, and make it fit for drinking and cooking purposes? A. The lime should have no place in the lining of the cistern. If you can clean out the cistern and free the surface of dirt by scrubbing with a steel brush, then plaster with pure Portland cement, you will improve the water as far as the lime affects it. The red color is probably due to leaves and dust lodged upon the roof and in the gutters. A clean roof is of the first importance where cistern water is the only recourse.

(5575) H. B. C. asks how to make a lacquer the color of gold leaf, to put on brass work, to make the brass work the color of gold leaf. A. Dissolve clear, light colored shellac in 95 per cent alcohol, 1 ounce to a quart. Settle in a bottle for a day and pour off the clear top solution. Add a little alcoholic extract of saffron or dragon blood gum to color to your taste by trial. If too thick, dilute with proof alcohol.

(5576) A. A. asks: Will you kindly state the condition of the Hudson River tunnel as it stands at present? A. It is completed about two-thirds of the distance under the river. Work stopped, waiting funds.

TO INVENTORS.

An experience of forty-four years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

December 5, 1893,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Accounts, means for keeping, Eastman & Babcock ... 510,011
Adjustable holder, W. A. Faber ... 509,884
Advertising device, J. H. Cairncross ... 510,157
Air brake apparatus, J. T. Hayden ... 509,898
Alarm. See Fire alarm. Thermometric alarm.
Ammeter and voltmeter, combined, E. W. Jewell ... 510,177
Animal trap, F. Baird ... 509,995
Auger, post hole, H. Zuber ... 509,994
Awning, F. A. Leavitt ... 510,274
Axle lubricator, W. J. Miller ... 509,928
Baby walker, J. W. Wood ... 509,991
Baling press, cotton, J. W. Graves ... 510,385
Baling press for cotton, etc., J. W. Graves, 510,386 to 510,388
Bandage rolling machine, G. A. Kelst ... 510,346
Basin, wash, W. H. Hodge ... 510,021
Baster, automatic, T. D. Brown ... 510,380
Bearing, axle, H. N. Hamilton ... 510,255
Bearing for wheels, axle, C. F. Lavender ... 510,179
Beating engine for pulping fibrous materials, J. Taylor ... 510,208
Bed and cabinet front, combined folding, Odegaard & Kuhnle ... 510,084
Beverages, method of and apparatus for making certain fermented, M. Warren ... 510,219
Bicycle, M. Acklin ... 510,227
Bicycle, G. R. Fenner ... 510,167
Bicycle, H. W. Libbey ... 509,919
Bicycle, Widerborg & Garfield ... 509,986
Bicycle saddle support, C. E. Luburg ... 510,275
Biscuit cutting and panning machine, J. Vicars *et al* ... 510,105
Bit. See Check bit Drenching bit.
Blind, cinder and dust, G. W. Bohde ... 510,237
Block. See Picture block.
Boiler diaphragm, W. King ... 510,347
Boomerang, C. W. Renear ... 510,290
Book clasp and handle, combined, M. T. Clancy ... 510,161
Book holder and reading stand, combined, L. Ludgin ... 510,075
Book rest, J. K. Brammer ... 510,323
Book support, adjustable, G. W. Poole ... 510,090
Boring apparatus for deep borings, A. Raky ... 510,366
Box. See Delivery box.
Bracket. See Dental engine bracket. Incandescent light bracket. Lamp bracket.
Bracket, J. A. Sellers ... 510,194
Brake. See Car brake. Railway brake.
Brake rod fork, G. W. Kelly ... 510,267
Brick, gutter, J. P. Gaffney ... 510,016
Brick kiln, P. Gonder ... 509,890
Brick kiln, continuous, J. Henney ... 510,135
Brick machine, D. P. Guise ... 510,066
Brick machine, H. Martin ... 510,077
Brick machine attachment, S. J. Van Stavoren ... 509,976
Brick machine reciprocating cut-off mechanism, O. W. Johnson ... 510,344
Brick mould, C. F. Kaul ... 510,265
Bridge, D. M. Eddy ... 510,064
Bridge construction, B. M. Kash ... 510,264
Brush, shaving, G. L. Belcher ... 510,152
Buckle, P. Mullane ... 510,358
Buckle, P. W. Odom ... 509,937
Buckle, D. W. Simmons ... 510,052
Budding knife, A. J. Speare ... 510,204
Burner. See Oil burner.
Burning fluid fuel, apparatus for, B. Brazelle ... 510,153
Button detaching machine, T. H. Seymour ... 510,197
Cable crossing, W. W. Bailey ... 510,151
Calendar, C. E. Hudson ... 510,262
Calendering machine, C. Moore ... 509,930
Canister, soap, F. H. Richards ... 510,294
Car brake, H. J. Small ... 510,200
Car brake adjuster, F. Slater ... 509,958
Car buffing and draw gear, G. W. Ettenger ... 510,334
Car coupling, B. Burglin ... 509,872
Car coupling, C. Christensen ... 510,160
Car coupling, S. Hamer ... 510,254
Car coupling, D. S. Hutton ... 510,343
Car coupling, G. Johnston ... 510,028
Car coupling, W. M. Jones ... 510,390
Car coupling, G. E. Mann ... 510,278
Car coupling, W. C. Nelson ... 510,360
Car coupling, H. Resley ... 510,291
Car coupling, E. Richter ... 510,190
Car coupling, J. H. C. & N. B. Smith ... 510,097
Car coupling, M. Zimmerman ... 509,993
Car cover, coal, T. M. Nalton ... 509,935
Car door, grain, G. W. Perry ... 509,941
Car door lock, J. Pearson ... 509,939
Car fender, F. W. Brown ... 509,996
Car sanding device, H. H. Hennegin ... 510,258
Car seat, reversible, J. E. Anger ... 510,374
Car, sleeping, A. Rapp ... 509,944
Car step, J. J. Steur ... 510,369
Car street, H. W. Hooton ... 510,138
Cars, ventilation of, S. G. Curry ... 510,001
Card, playing, W. Doerflinger ... 509,881
Carpet fastener, C. E. Piper ... 510,089
Carpet stretcher, W. A. Phillips ... 510,361
Carriage, baby, F. P. Mann ... 510,355
Cartridge shell crimper, W. H. Nichol ... 510,187
Cash register and indicator, J. A. Treat ... 510,211
Cash register, indicator, and recorder, W. T. McGraw ... 510,083
Casting machine, type, H. S. Popp ... 510,288
Casting solid ingots of steel, W. P. B. Urick ... 509,973
Centrifugal drier, H. M. Saint-Denis ... 510,298
Chain link, R. A. Breul ... 510,238
Chain link, C. R. Harris ... 510,134
Chair fan attachment, rocking, J. H. Macartney ... 509,926
Chart, dress, H. Poulin ... 510,364
Check bit, M. W. Case ... 510,158
Check row wire anchor, J. B. Lasure ... 509,913
Checks, manifolding device for baggage, C. H. Brown ... 509,869
Chuck, screw machine, Saum & Blackman ... 510,191
Churn, W. Dobson ... 509,880
Circuit breaking apparatus, J. Burry ... 510,156
Clarinet, J. Clinton ... 510,119
Clasp. See Book clasp.
Clasp, W. B. Draper ... 510,333
Clip. See Spring clip.
Closet. See Dry closet.
Clothes wringer, W. I. Gong ... 510,171
Coagulant feeder, J. H. Blessing ... 510,112
Coating iron with magnetic oxide, P. H. Bertrand ... 510,318
Cock, gauge, T. A. Delaney ... 509,879
Coffee roaster, gas, K. F. Henneman ... 510,068
Coin carrier, T. F. Gaynor ... 509,888
Coin-controlled device, P. C. Oscanyan ... 510,086
Combination lock, Bexell & Peterson ... 510,234
Commutator brushes, composition and process of producing same for, Hirsch & Meminger ... 510,341
Compasses, trammel point for beam, W. J. & A. W. Houck ... 510,139
Condenser, surface, F. M. & C. H. Wheeler ... 510,373
Condensing apparatus, F. M. Wheeler ... 510,107
Copy holder, H. E. Gifford ... 510,130
Copying press, E. W. Rider ... 510,296
Corn popper, J. F. Johnson ... 510,027
Cotton gin rib, G. Lemain ... 510,073
Cotton ginning apparatus, R. King ... 510,269
Coupling. See Car coupling. Thill coupling. Wagon reach coupling.
Coupling, J. Long ... 510,353
Crane, overhead traveling, W. H. Morgan ... 510,041
Crankshafts, machine for making, Thomas & Fitzgerald ... 510,103
Crockery ware pipes, etc., composition of matter for the manufacture of, J. B. F. Fredureau ... 510,065
Culinary device, S. E. Dysinger ... 510,010
Cultivator, S. L. Allen ... 509,857
Cultivator, A. Mattijetz ... 510,281
Cultivator attachment, wheel, S. D. Poole ... 510,091
Cultivator, walking, E. A. Ovenshire ... 510,044
Cup. See Egg cup.
Cutter. See Vegetable cutter. Vegetable or meat cutter.
Cutting and gripping tool, J. Lindsay ... 509,920
Cyanides, process of and apparatus for making, W. Siepermann ... 509,957
Cycle speed gearing, G. Glydon ... 510,252
Cyclometer, adjustable, C. Coulern-Meuri ... 510,328
Damper, fireplace, E. J. Johnson ... 509,911
Damper regulator, A. Catchpole ... 510,060
Decorticator, A. Vansteenkiste ... 510,304
Delivery box, H. S. Tuthill ... 510,212
Dental engine bracket, extensible, H. Hobbs ... 509,901
Dental implements, electrical apparatus for operating, O. H. Pieper ... 510,048
Digger. See Potato digger.
Dish drainer, F. Mitchell ... 510,185
Door check, J. M. David ... 510,163
Door hanger, W. Cronk ... 510,000
Dough mixer, M. A. Wilcox ... 509,987
Drenching bit, T. B. Swan ... 509,968
Dress shields, method of and device for forming, G. S. Squires ... 510,099
Drier. See Centrifugal drier.
Drill. See Hand drill. Ratchet drill.
Drilling machine, Michaels & Green ... 510,039
Drilling machine, R. F. Wyatt ... 510,148
Dry closet, H. H. Jensen ... 509,910
Duplicating machine, R. Morgeneier ... 509,931
Dye, blue azo, M. Moeller ... 509,929
Easel, C. E. Fountain ... 510,250
Eccentric, J. Clayton ... 510,118
Egg cup, E. W. Orth ... 510,085
Ejector, W. B. Hollingshead ... 510,389
Electric arc lighting system, D. Higham ... 510,260
Electric lighting system, G. B. Pernock ... 510,188
Electric line work, emergency wagon for, E. S. Breed ... 510,113
Electric machine, dynamo, C. E. Scribner ... 509,954
Electric machine regulator, dynamo, C. E. Scribner ... 509,953, 509,955
Electric motor, A. H. Beard ... 510,059
Electric motor or dynamo, H. K. Thiel ... 510,102
Electric motor, reciprocating, A. R. Roe ... 510,367
Engine. See Beating engine. Gas engine. Gas motor engine. Reversing engine. Steam engine.
Engine attachment, steam, F. T. Guiber ... 510,131
Engine reversing mechanism, A. J. Schindler ... 510,094
Engine tender, traction, A. T. Finke ... 509,886
Engines, means for operating, G. & H. Honig ... 510,394
Eraser, I. W. Heysinger ... 509,899
Evaporating pan, Lexa & Herold ... 509,918
Extension table, W. L. H. Hall ... 509,894
Extension table, J. Pogodzinski ... 510,362
Extractor. See Wedge extractor.
Feedwater purifier attachment, E. R. Stilwell ... 510,300
Feedwater purifying apparatus, boiler, J. T. C. Knight ... 510,272
Fence post, W. C. Kilner ... 510,030
Fence, wire, H. Haynes ... 510,257
Fence, wire, H. D. Miller ... 510,040
Fencing wire, implement for tightening and splicing, Sessions & Embrey ... 510,299
Fender. See Car fender.
Ferrule, umbrella, F. S. Chase ... 510,159
Fertilizer pulverizer and distributer, A. W. McConnell ... 509,933
Fibrous plants, etc., apparatus for treating, W. T. Forbes ... 510,168
File cutting machine, G. Schmidt ... 509,949
File, letter, J. Lochmann ... 510,350
File, letter, Tiffany & Brewer ... 509,972
Filter, artificial stone, Fischer & Peters ... 509,887
Filter, water, A. H. Koblmeyer ... 510,348
Fire alarm, electric, M. C. Cantrell ... 510,115
Fire escape, H. Coyle ... 510,383
Fish tilt, floating, F. Stiner ... 510,205
Flange wrench, adjustable, J. W. Kellam (r) ... 11,394
Flask, H. J. Graf ... 510,172
Flat iron, F. J. Jenkins ... 510,025
Foil, manufacture of metal, E. Schroder ... 509,951
Folding table, E. F. Bassett ... 510,232
Folding tub, J. Mariani ... 510,356
Frog foot guard, D. D. Zweig ... 510,226
Fruit clipper, F. E. Wood ... 509,990
Fruit picking apparatus, Stodder & Eastman ... 510,055
Fuel, apparatus for making artificial, H. S Albrecht ... 510,228
Fumigating apparatus, J. M. Miller ... 510,079
Funnel, H. Strater ... 509,966
Furnace. See Smelting and refining furnace.
Garden rake, J. A. Linn ... 509,921
Gas engine, G. E. Hoyt ... 510,140
Gas engine, compression, H. W. Tuttle ... 510,213
Gas motor engine, C. B. Wattles ... 509,981
Gate. See Swinging gate.
Gear cutting and hobbing machine, U. Eberhardt *et al* ... 510,122
Gear cutting machine, U. Eberhardt *et al* ... 510,121
Gear, reversing, C. Ward ... 510,215
Gearing, E. D. Speer ... 510,368
Glass. See Toilet glass.
Glass rolling apparatus, N. M. Miller ... 510,080
Glass rolling device, R. Gray ... 510,338
Governor, engine, J. Begtrup ... 510,312 to 510,315
Governor, safety stop, J. Begtrup ... 510,316
Grain binder, P. Hanson ... 510,174
Grain dump, portable, C. L. Young ... 510,225
Grapple, H. N. Smith *et al* ... 510,053
Grater, vegetable, M. Josephson ... 510,141
Grill for door or window openings, P. Tiedge ... 509,971
Grinding machine, saw, H. Ehrhardt ... 510,165
Grinding machine work carrying device, T. Settle ... 510,196
Guitar winding key, J. Ayuso ... 510,375
Gutter beading machine, Oberle & Faller ... 509,936
Hammer, J. Ryan ... 510,049
Hammer, drop, Hatch & Murphy ... 509,897
Hammock bodies, securing suspension loops to the ends of, I. E. Palmer ... 510,087
Hand drill, M. M. Olm ... 509,938
Hand rake, W. Cronk ... 509,999
Handle fastener, tool, M. Carman ... 510,326
Handle for erasers or brushes, E. J. Wahl ... 510,106
Handles to implements, device for attaching, J. Klemm ... 510,271
Hangings, machine for ornamenting, R. Berkan ... 510,110
Harrow and clod crusher, combined, S. B. Flynt ... 510,126
Harrow, rotary wheeled, J. B. Kelsey *et al* ... 510,143
Harrow, sulky, A. Larson ... 510,071
Hat brim curling machine, McGall & Hilsinger ... 510,359
Hay knife, A. Mosier ... 510,357
Head or arm rest, M. Moody ... 510,282
Heating systems, apparatus for regulating the temperature of hot water, A. Mercer ... 510,183
Heeling machine, A. D. Elliott ... 510,012
Hinge, W. Veitch ... 509,979
Hinge fastening blind, H. Mullins ... 510,082
Holdback, vehicle, C. W. Collyer ... 510,327
Horse detacher, J. E. Norwood ... 510,284
Horses, fore-leg spreader for, G. Glascock ... 510,337
Hub box, wheel, S. S. Arnold ... 510,229
Hydraulic motor, Kirk & Hazel ... 510,270
Hygienic vapor and hot air renovator, H. I. Blits ... 510,235
Incandescent light bracket, C. M. Berry ... 510,317
Index, parliamentary, J. H. Gore ... 509,891
Indicator. See Lamp filling indicator.
Ink well, W. E. Lewis ... 509,917
Insulator for heating pipes, tubes, or flues, S. D. Stauffer ... 509,963
Iron. See Flat iron. Sad iron.
Jack. See Lifting jack.
Jar closure, F. H. Palmer ... 510,045
Key leveling device, Lehr & Diehl ... 509,915
Key ring, A. W. Engel ... 510,247
Key ring, J. M. Matthews ... 510,280
Kiln. See Brick kiln. Pottery kiln.
Knife. See Budding knife. Hay knife. Pocket knife.
Ladder, fire, F. A. Biehn ... 510,111
Ladder, step, A. Barr ... 510,108
Lamp bracket, F. O. Tarbox ... 510,147
Lamp extinguisher, W. P. Quentell ... 509,943
Lamp filling indicator, T. W. Bartholomew ... 510,311
Lamp, incandescent electric, H. Green ... 510,018
Lamp shade, electric, G. F. Seavey ... 510,095
Lamp standard, extensible, M. M. Deem ... 510,243
Lamp support and connection, arc, L. E. Thompson ... 510,303
Lanterns, means for holding globes in, W. C. Winfield ... 510,058

© 1893 SCIENTIFIC AMERICAN, INC

Latch, L. E. Jacobus 510,176
Latch, gate, G. W. Mallory 510,181
Latch, wagon end gate, A. R. Smith 509,960
Leaf turner, J. B. Williamson 509,988
Lid, vessel, F. E. R. Malke 510,354
Lifter. See Mail pouch lifter.
Lifting jack, C. W. Ball 510,230
Lister for sod land, G. W. Scott 509,952
Loading platform, Suer & Bobe 510,206
Lock. See Car door lock. Combination lock.
Loom shuttle check and binder, A. N. Reeves 509,945
Lubricator. See Axle lubricator.
Lubricator, M. Booth 509,864
Lubricator, S. Irving 509,908
Magneto apparatus, A. F. Boardman 510,320
Mail pouch lifter, R. J. Hunt 509,906
Mail receiving and collecting apparatus, W. O. Taylor 509,969
Mandolin, A. C. Fairbanks 510,335
Match safe and cigar cutter, combined, U. Porstendorfer 509,942
Matrix making machines, justifying mechanism for, J. A. Watson 510,305
Matrix pages, machine for justifying, Lake & Risley 510,032
Measuring instrument, electrical, O. T. Louis 510,074
Mechanical movement, T. C. Van Wyck 509,977
Metal blanks into cutters, machine for cutting, J. W. Taylor 510,207
Metal film and metal paper, producing, C. Endruweit 510,013
Metal, ornamenting, J. H. Hines 510,340
Metal pouring device, J. Downs 510,062
Metal upon metal, depositing, P. H. Bertrand 510,376
Metallic chlorides, electrolytically decomposing fused, F. M. Lyte 510,276
Mixer. See Dough mixer.
Motor. See Electric motor. Hydraulic motor.
Musical instrument, mechanically played, O. P. Lochmann 510,351
Nail, W. C. Lipe 510,035
Non-conducting covering, H. W. Johns 510,026
Nut for screw bolts, locking, L. W. Crosta 510,120
Nut lock, J. C. Brown 509,870
Nut lock, C. P. Howell 510,023
Nut lock, G. L. Odgers 510,285
Nut, spring locking, C. P. Dorr 510,245
Oil burner, J. Aitchison 510,149
Oils, apparatus for burning hydrocarbon or other, G. Gerrard 510,170
Ores, system for concentration of, C. E. Seymour 510,051
Organ coupler and connection, Lehr & Diehl 509,914
Packing, metallic rod, J. L. Halyburton 509,895
Pan. See Evaporating pan. Vacuum pan.
Paper, etc., apparatus for cutting, R. W. Wilton 509,989
Paper bag machine, J. M. & O. M. Carter 509,874
Paper coating or enameling machine, W. Sparks 510,098
Paper roll holder and fare register, D. F. Bowen 510,392
Paper weight and clamp, combined, I. W. Heysinger 509,900
Pavement, W. F. Higgins 510,259
Pavements, making concrete, G. A. Bedgood 510,233
Pawl and ratchet coupling for rotating tools, H. N. Parker 510,046
Pen and ink reservoir, drawing, H. Holtzel 509,905
Pen, fountain, J. Blair 509,862
Pen, fountain, W. Post 510,145
Penholder, C. W. Boman 510,322
Penholder, A. T. Record 510,092
Photographic printing machine, C. Van Buskirk 510,371
Picture block, O. Waibel 510,216
Pile driver, F. E. Shaw 510,198
Pin. See Safety pin.
Pipe threading machine, L. B. Curtis 509,878
Pipe turner, A. F. Foster 510,169
Pipe wrench, W. A. Jennings 509,909
Pipe wrench, H. Martini 510,182
Plane, bench, J. Siegley 510,096
Planter and fertilizer distributer, seed, S. L. Allen 509,856
Planter attachment, corn, K. L. Kammerer 510,069
Planter, corn, J. W. Barlow 510,231
Planter, corn, F. A. Newell 510,186
Planter, corn and cotton, J. D. Schofield 509,950
Platform. See Loading platform.
Plow, A. R. Fancher 510,125
Plow and seeder, combined, K. Reichwein 509,946
Plow, sulky, Poole & Cross 510,363
Pneumatic-tired wheel, L. Holt 509,902
Pneumatic tool, E. W. R. Von Buhler 510,155
Pneumatic wheel, R. Perkins 509,940
Pocketbook, V. Le Brun 510,072
Pocket knife, G. F. Lundquist 510,038
Pole tip, vehicle, T. J. Houghton 510,022
Post. See Fence post.
Post office box, H. A. Sheldon 510,199
Potato digger, G. H. Kidney 510,070
Pottery kiln, C. F. Wohlschlegel 510,223
Press. See Baling press. Copying press.
Pressure regulator, thermostatic, O. Gassett 510,017
Printing and folding mechanism, L. C. Crowell 509,877
Printing attachment for envelope machines, H. L. Newell 510,043
Printing machine, W. Scott 510,193
Printing machine, platen, C. E. Sawyer 510,146
Printing press feeding mechanism, F. H. Van Loozen 509,974
Propelling apparatus, boat, T. D. Clapham 510,117
Protector. See Skirt protector.
Pulley, speed, W. M. McIntyre 510,283
Pulverizer and roller, combined, G. R. Farmer 510,166
Pump, suction and force, J. H. Lawless 510,180
Purifier, E. R. Stilwell 510,301
Puzzle, C. A. McFadden, Jr 509,934
Radiator, J. F. Donahoe 510,244
Radiator or heater, portable steam, C. R. Harris 510,067
Rail sweeper, H. A. Bruhns 509,871
Railway brake, elevated, W. L. Reynolds 510,292
Railway, conduit electric, W. R. De Voe 510,061
Railway rail, C. L. Travis 510,391
Railway rail joint, L. Burkhart 510,381
Railway rail joint, L. W. Kennedy 510,268
Railway signal, J. A. Rogers 510,297
Railway switch, J. C. McLaughlin 510,144
Railway switch, electrically-operated, H. L. Falco 510,384
Railway tie plate, W. Pfefferkorn 510,047
Railway trolley, conduit, P. C. Just 510,142
Railways, permanent way for, S. Rideal 510,295
Rake. See Garden rake. Hand rake.
Ratchet drill, W. Griesser 509,893
Refrigerator, A. Larsen 510,273
Refrigerator, T. Schoppe 510,192
Register. See Cash register.
Regulator. See Damper regulator. Electric machine regulator. Pressure regulator.
Rein, driving, H. F. Easton 509,882
Reversing engine, C. Hammen 510,256
Reversing mechanism, W. Kuebler 510,031
Ring. See Key ring.
Road crossing, H. H. Faust, Jr 509,885
Roaster. See Coffee roaster.
Rubber shoe, M. Mayer 509,927
Ruling device, K. M. Hurlburt 509,907
Ruling machines, ink fountain for paper, L. S. Bigelow 509,861
Sad iron, W. Mitchell 510,081
Safety pin, D. A. Carpenter 509,998
Sash balance, R. K. Brown 510,154
Sash fastener, D. O. Livermore 509,922
Saw straightening and expanding machine, I. Toomer 510,210
Sawmill carriage offsetting device, J. McAllister 510,042
Sawmill feed mechanism, J. L. Barnes 509,859
Scaffold, ladder, T. C. Williams 510,057
Scale, computing, Blair & Giffen 510,319
Scraper or shovel, J. A. Campbell 509,875
Screen. See Window screen.
Screw cutting machine, J. Davidsohn 510,329
Screw hooks, tool for holding, J. Uhl 510,104
Screw machine, J. Hartness 510,020
Screw threads, die for rolling, W. O. Bement 510,109
Screws, method of and machine for feeding, G. Wood 510,224
Seam turning machine, O. A. Webber 509,983
Sewing machine for barring buttonholes, E. Z. Taylor 509,970
Sewing machine trimming attachment, T. H. Hollingsworth 510,342
Sewing machines, welt guiding device for shoe, E. P. & E. F. Arnold 510,150
Shades, holding mechanism for spring-actuated, E. T. Burrowes 510,114
Sheathing and lath, combined wooden, H. C. Forsyth 510,015
Sheet metal cylinders, machine for forming, E. Small 509,959
Shelf roller, P. J. Pauly, Jr 510,088
Shutter, fastener, Davis & Gartner 510,164
Siccatives, making, G. W. Scollay 510,050
Sifter, ash, G. Wexler 509,984
Signal. See Railway signal.
Sink and dish drainer, combined, G. C. Geraty 510,129
Skirt protector, N. J. Buchanan 510,324
Sled, Wilde & Campbell 510,221
Sleigh, H. B. Ellsworth 510,123
Sluice, amalgamating and reducing, J. H. Jory 509,912
Smelting and refining furnace, reverberatory, J. L. Giroux 510,251
Sole gouging machine, French & Meyer 510,127
Souvenir holder, T. F. Gaynor 509,889
Spader or digger, G. Keizer 510,266
Spectacles, H. W. Collins 510,240
Spectacles, J. F. Sumner 509,967
Spindle and bearing therefor, J. W. Wattles 509,982
Spooling yarn, bobbin holder for, J. D. Aiken 510,309
Spoon, W. J. Osterman 510,286
Spout, sap, J. F. Warner 509,980
Spraying and sprinkling machine, portable, T. Peppler 510,287
Spring. See Wagon spring. Wagon seat spring.
Spring clip, W. J. Kauffman 510,345
Spring jack cleaner, C. G. Brady 509,867
Stamp, marking, C. L. Anton 509,858
Steel ribbons, apparatus for coloring, J. Logan 510,352
Steam engine, duplex, C. M. Miller 510,184
Stock securing and releasing device, C. K. J. Raben 510,365
Stone, artificial, J. Lorenz 509,924
Stove, M. Gray 509,392
Stove, gas, T. Hipwell 510,136
Stove, oil, C. H. Boeck 510,236
Stoves, deflector for heating, C. A. Richardson 509,948
Sulky, J. P. Faber 510,248
Surgical dressing sterilizer, E. Boeckmann 510,321
Surveying instrument, J. Henderson 510,339
Swinging gate, J. H. Dundas 510,063
Switch. See Railway switch.
Switch, G. Hargreaves 509,896
Switchboard testing apparatus, multiple, F. R. McBerty 509,932
Table. See Extension table. Folding table.
Tannin from other bodies, separating, O. C. Hagemann 510,132
Teakettle, O. W. & J. A. Boston 509,865
Teaching music, device for, R. Thew 510,302
Teaching penmanship, device for, C. R. Wells 510,372
Telegraph key, J. Steiner 509,964
Telegraph, signaling, M. J. Burns 509,873
Telegraphy, P. B. Delany ..... 510,002 to 510,007
Telegraphy, electric, C. Thom, Jr 510,209
Telephone exchange system, automatic, J. Serdinko 510,195
Telephone switchboard annunciator, C. E. Scribner 509,956
Telephonic transmission, J. S. Stone 509,965
Tent, bed, and knapsack, combined, A. E. Carr 510,239
Thermometric alarm, O. Weyrich 509,985
Thill coupling, J. W. Hoddinott 510,175
Thill coupling, C. C. Martin 510,078
Thill coupling, M. H. Risser 510,093
Thill coupling, vehicle, G. M. Weaver *et al* 510,220
Thrashing machine, A. R. Gustafson 510,253
Ticket, C. S. Smith 509,961
Tile dressing machine, I. Broome 509,868
Tin and terne plates, apparatus for coating, T. H. Griffiths 510,173
Tire fastening, bicycle, J. L. Yest 510,307
Tire, pneumatic, R. R. Gubbins 510,019
Tire, pneumatic, L. Holt 509,903, 509,904
Tire, pneumatic, F. Veith 509,978
Tire protector, M. H. Lothrop 509,925
Tires to wheel rims, device for securing, A. Conningsby 510,382
Tires, valve for pneumatic, E. J. Vauzelle 510,215
Toaster, bread, E. Leslie 509,916
Toilet glass, O. Lunders hausen 510,076
Tongs, J. F. Lundahl 510,037
Tongue support, J. S. Faulkner 510,249
Tooth roots, device for measuring, A. I. F. Buxbaum 510,325
Toy, flying, C. M. Hollingsworth 510,137
Toy for games, W. Lawrence 510,033
Toy, gyroscopic, C. Adam 510,308
Toy, mosaic, W. Konig 510,178
Trap. See Animal trap.
Trolley and trolley switch, D. V. B. Smart 510,201
Trolley wire support, J. E. Walker 510,217
Truck, car, B. F. Manier 510,277
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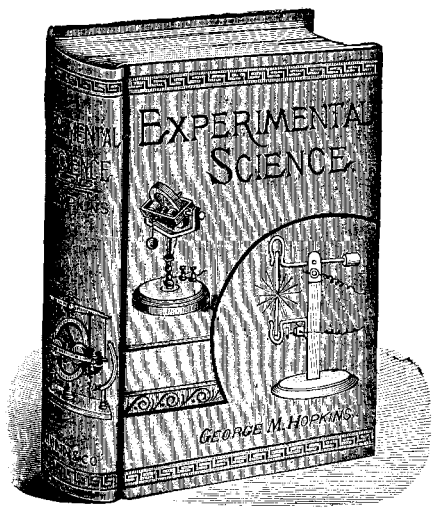

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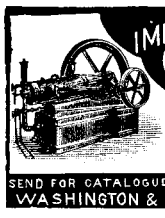
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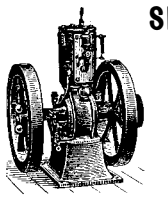
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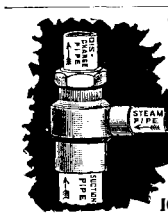

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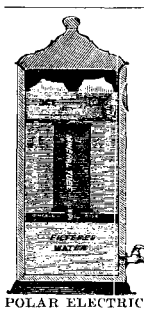

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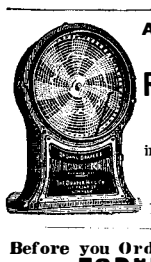

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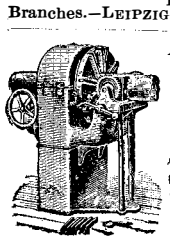

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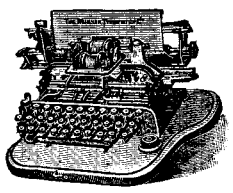

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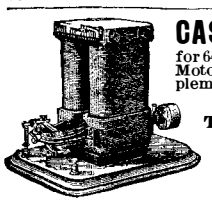

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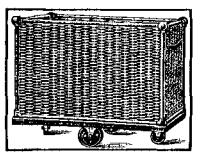

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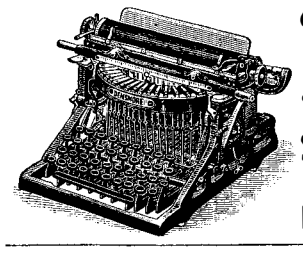

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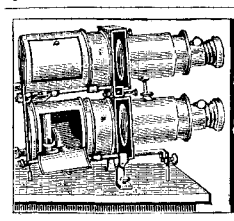

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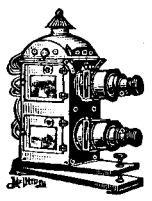

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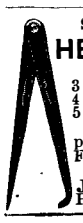

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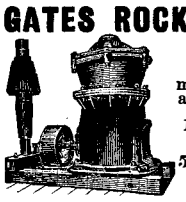

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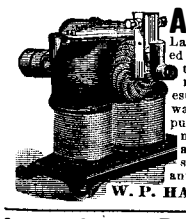

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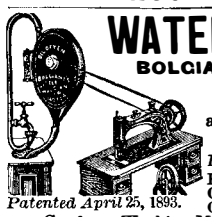

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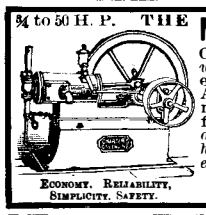

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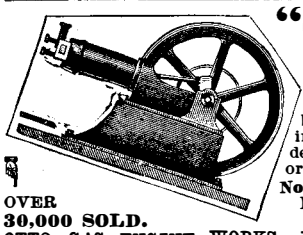

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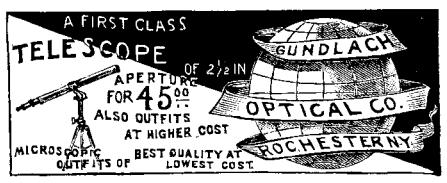
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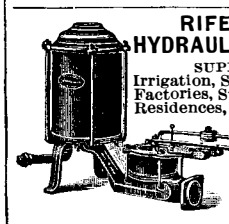

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